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## FINDING DIRECTION BY MEANS OF SUBMARINE SOUND SIGNALS.

The article by Mr. Lucien I. Blake, on page 754, discusses a subject which is really not electrical at all, except in so far as a microphone-telephone apparatus constitutes the intermediate device between sound waves in the hull of a steamer and the ear of an officer on the bridge. The apparatus described is, however, of practical importance to navigators. A submerged bell at a marine station is struck periodically, and vessels within a certain radius are able to make the sound audible to the officer in charge, by means of a microphone in a small water-tank fastened to the interior of the vessel's hull below the water-line. By having one such receiver on each side of the ship, the officer is enabled to judge of the bearing of the bell by the contrast between the sound received on the two sides. The principal question discussed mathematically is whether the hull of the vessel casts a sound-shadow, or not. The best answer to this complex question is, however, obtained experimentally, and it is stated to have been found by actual trial that even a battle-ship 420 ft. long and drawing 25 ft., casts no sound shadow, when the source was half a mile off. The principal value of the mathematical analysis is, therefore, in demonstrating the reasons for the observed diminution of sound intensity as the angle of incidence increases, measured from the vessel's beam. As usual, the great sensitiveness of the telephone enables it to be used with much advantage as the receiving instrument. Also, as usual, the telephone does not readily lend itself to quantitative research as to the amplitude of the sounds received. The subject is clearly one of considerable complexity and any theoretical conclusions dealing with it may need to be modified to cover facts, so that the whole problem is one that warrants careful research from a technical standpoint.

## THE RESISTIVITY-TEMPERATURE COEFFICIENT OF METALS.

In all computations connected with dynamo-electric machinery, the correction of the resistance of copper windings from an observed to a standard temperature, is of constant occurrence. This makes the computation of the temperature correction a matter of practical importance, and everything that can facilitate this computation economizes effort and is worth careful attention. The first experimenter to observe and publish the resistivity-temperature coefficient of copper and also of other common metals was Matthiessen, who published the main results in the *Philosophical Transactions* of the Royal Society for 1862.

As was clearly discussed in an article recently printed in these columns by Prof. Crocker, the original formula of copper-

resistivity correction of Matthiessen, was really a conductivity-correction formula of the parabolic type, or one which involved the square of the temperature, as well as the temperature itself. Tables for correcting the resistance of copper wires from one temperature to another, based on Matthiessen's formula, were almost universally employed by electrical engineers until about 14 years ago. About that time it began to be generally recognized that ordinary good commercial copper had a resistivity-temperature coefficient which followed a straight-line law, at least nearly enough for practical purposes, between the temperatures of 0° and 100° C. The only question was as to the slope of the straight line. Different observers reported results differing between 0.40 and 0.41 per cent of the resistivity at 0° C. per degree Centigrade rise. The American Institute of Electrical Engineers adopted the value 0.42 per cent in its standardization report of 1902. The ordinary expression of this relation in a formula usually leads to two computations in correcting an observed resistance, at say, 20° C., to the temperature of say, 50° C. The first step is to find by the formula what the resistance would be at 0° C., and then entering the formula a second time with this value, to find what the resistance would be at 50° C. A plan was recently suggested in these columns to economize time, and save taking two bites at the cherry of correction, is to use a table of graded temperature-coefficients, based on the straight-line law, the coefficient varying from degree to degree. Another plan suggested by Dr. Harold Pender in this number is to use what may be called the virtual absolute temperature of resistivity, a method that lends itself well to the slide rule.

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From thermodynamic considerations, we are led to accept the proposition that a perfect gas would be devoid of all expansion energy at a temperature of —273° C. In other words, a gas at constant pressure increases its volume with temperature according to a straight-line law, such that the volume would shrink to zero at —273° C. This is the temperature of the so-called absolute zero, and the volume of a gas will be proportional to its absolute temperature on this scale, counting 0° C. as 273° Abs. and 100° C. as 373° Abs. The fact is, however, purely inferential, so far as concerns the zero volume at absolute zero; because, although temperatures of less than 50° Abs. have been reached experimentally, none has yet produced a temperature of 0° Abs. Similarly, copper has a resistivity which is not exactly zero at any low temperature yet experimentally reached, but which is zero, by inference, at a temperature of —238.°1 C. if we accept the temperature coefficient of 0.42 per cent for ordinary ranges of temperature above 0° C. According to this idea, a temperature of 0° C. would be 238° Abs. on the resistivity scale of copper, 20° C. would be 258° C. Abs. on copper, 100° C. 338° Abs. and so on. The resistivity of copper is then simply proportional to the absolute temperature on the copper scale. Dr. Pender shows how a slide rule can be marked off in ink with Centigrade temperatures corresponding to copper absolute temperatures without having any new scale cut on the instrument, so as to save even the mental effort of reducing temperature on the Centigrade scale to temperatures on the copper absolute scale. The absolute temperatures of the ordinary metal does not differ greatly from their absolute temperature as reckoned thermodynamically from —273° C., except in the cases of the two magnetic metals, namely, iron and nickel.

## The Street-Lighting Situation.

Cities and companies about to decide upon changes in methods of street lighting certainly find themselves at the present time in a confusing situation due to rapid changes in the art now occurring or which are imminent. It was but a short time ago when the only electric illuminants generally considered for street lighting were the old-fashioned low-efficiency incandescent lamp and the enclosed alternating current arc lamp. The recent marked improvement in the efficiency of the incandescent lamp by the introduction of the graphitized carbon filament would have alone put incandescent street lighting in a position for much more favorable consideration than in the past, but on top of this comes the advent of the tungsten filament lamp and possibly several others of equal efficiency. These high-efficiency incandescent lamps would be enough to put the enclosed carbon arc lamp out of consideration altogether, but improvements in the arc lamp field have almost kept pace with those in the incandescent field, so that we now have as a substitute for the ordinary enclosed carbon arc certain luminous and flaming arcs of so much higher efficiency than the ordinary carbon arc that the arc lamp bids fair to hold its relative place among electric street lighting illuminants. To sum up, there has simply been a big increase in the efficiency all along the line, and we have with us the same old problem of whether it is better to scatter incandescent lamps at frequent intervals along a street or place arc lamps at much less frequent intervals. Thanks to the fact becoming recognized that the ability to see one's way well along a street is usually more important than a lot of glare, it is now very generally accepted by those who have given the subject study that for the lighting of residence streets in small towns and in the suburbs of large cities, incandescent lamps placed two or three to a block give superior results to an equivalent amount of electrical energy put into arc lamps.

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The question as to whether small or large units shall be used should be determined largely by the total amount of electrical energy to be expended on a given length of street. On a street where the expenditure of considerable energy would be justified, it is quite permissible to use large units for the simple reason that these units will be spaced at frequent intervals. Where but a small amount of energy can be expended per mile of street, as is the case in the great majority of the towns of this country, it will have a most blinding effect to put this energy in the shape of large units for the reason that this will necessitate the use of such units at very infrequent intervals. On many streets an expenditure of energy equivalent to one arc lamp on every second crossing is all that the town thinks it can afford. The result of such an arrangement in poor illumination need not be told to anyone who has walked along such streets. When the amount of energy expended per mile of street is sufficient to afford an arc lamp at every crossing, conditions are much improved, although there is room for consideration of the question whether a smaller unit every half block would not serve the purpose better. The blinding effect of the large unit and the infrequent intervals at which it must be placed handicaps it very much.

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Practically the only thing which will keep down the rapid introduction of small units in street lighting when their ad-

vantages are fully understood is the cost of construction where many small units are used. Every lighting unit placed adds to the cost of construction, and while it may cost a little less per lamp to hang up a small unit than it does a large one, the cost of hanging up the small unit is all out of proportion to its size. Some seem to think that where small units are used on underground work, a post should be provided as elaborate for the small unit as for the large. Many of our arc lamp-posts now used are unnecessarily large and heavy and have on them an amount of attempted ornamentation that will doubtless be considered bad taste within a few years. When it comes to street lighting by overhead wires, as in the case of most residence streets outside of large cities, the suspension employed for incandescent lamps need be nowhere nearly as expensive as that used for heavy arc lamps. In some towns one of the principal difficulties of placing lamps between crossings is the trouble of getting wires through the shade trees along the street. In not a few of these towns the streets were abandoned in favor of the alleys for the location of electric light wires many years ago. However, this problem of placing incandescent lamps two or three a block has been successfully and cheaply solved in many a country and suburban town, and there are undoubtedly hundreds of towns now lighting their residence streets with arc lamps placed every second crossing that could do much better with incandescents placed two to each block, and requiring no more energy in the aggregate.

## Questions of High Tension.

The continued high price of copper lends especial interest to the study of high voltages in power transmission. At present figures the economics of long lines are very seriously affected. A system which five years ago would have invested, say, $50 per kw, now must invest not less than $75 per kw in conductors. The difference is practically as great as the whole cost of the electrical machinery including the transformers, and within that period there has been very little advance in working voltage. The average, it is true, has been raised, but the maximum has been but little raised. There has been indefinite talk about what was about to be done, and we believe some transformers designed for a maximum of 80,000 volts have been built and shipped—for actual installation on considerably lower voltage. Now, since an actual rise in working pressure from 60,000 volts to 75,000 would fully compensate for the additional present price of copper, and discourage further increases of price, it would seem to be high time for action. At the lower voltages there is a similar incentive, and in general the first reply to an extortionate price of copper ought to be an increase of working pressure to reduce the demand for copper. We say extortionate advisedly, for the present figures seem to be higher than can fairly be accounted for by entirely natural causes. However this may be, the fact that it is possible for copper to be held for a long period at present figures demands a remedy.

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Looking over the transmission situation it would appear that the logical step first to be taken is to raise the normal transmission voltage considerably above its present figure. It has been abundantly demonstrated that pressures of 40,000 to 50,000 volts can be worked with entire success almost anywhere in the country, and some plants are doing good work at or above 50,000. Why then build plants for compromise pressures like 20,000 and 25,000 volts and more than double the cost of the line? If the extra money is to be blown in, it had better be put in duplicate supply lines and hydraulic work instead of paid to the copper speculators. Further increase of voltage rests in the main with the makers of insulators. At 60,000 volts working pressure the factor of safety in the insulator is apt to be low—in fact, we have never seen an insulator for this pressure given what we would call a conservative rating. But at 40,000 volts one can secure a factor of safety large enough to suit almost anybody. There should be no hesitation about dealing with such voltage wherever the copper question begins to get serious, and the distance of transmission is more than trivial. The really serious part of the problem lies in the region above 60,000 volts and particularly in cases where for commercial success this limit should be very considerably raised. It is for such cases that our foreign *confrères* are again talking of direct-current transmission. The experiments of M. Thury several years ago had shown pretty conclusively that the striking distance and puncturing power of a direct e. m. f. up to 60,000 volts at least was only about one-half that of an alternating electromotive force represented by the same effective voltage, and a similar ratio can probably be substantiated for even considerably higher pressures.

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This means that an insulator having an adequate factor of safety at, say, 50,000 volts alternating e. m. f., could be used with equal safety at 100,000 volts direct e. m. f., or what amounts to the same thing, that the direct-current line could get along with about one-fourth the copper at equal loss. One can hardly wonder then that the direct-current system is being taken into consideration for schemes like that at Victoria Falls where the success of the enterprise hinges upon the use of very high voltage. M. Thury has been a sort of voice crying in the wilderness for a good many years, but now that engineers are facing into the unknown country that lies beyond 100,000 volts, he is obtaining a serious hearing and is rallying to his support a force of opinion that cannot fairly be neglected. Two practical factors in operation must be reckoned in his favor, aside from minor matters. In the first place there is every reason to think that lightning protection in its broadest sense is very considerably easier with direct current than with alternating current transmission. Second, in these days of selling energy at wholesale, a large block such as can easily be delivered on the direct current system is salable, whereas a few years ago the transmitting company would have been obliged to burden itself with distribution. When the substation reduces to a case of motor generators, direct current transmission is relatively easy. But the crux of the problem is the same that it always has been—the possibility of getting the output required with a reasonable number of units. M. Thury has built generators even for 25,000 volts, but for a current, if we remember aright, of only about one ampere. The introduction of commutating-pole construction may render the task of building high-voltage direct-current generators easier, but until one can get much larger units than have yet been made available, direct-current transmission will make slow progress. The existence of a satisfactory 10,000-volt generator for 100 amperes would make the direct-current case very much stronger.

## New Schedule of Energy Rates in Chicago.

The Commonwealth Electric Company and the Chicago Edison Company have established a new three-rate system for energy customers. Along with this change the minimum bill for motor service has been reduced from $1 to 50 cents per horsepower connected. The three-rate system is as follows:

Ten cents per kw-hour for that portion of the metered consumption equivalent to the first thirty hours' use per month of the maximum demand. For that portion of the metered consumption in excess of thirty hours' use per month of the maximum demand, and up to sixty hours' use, 5 cents per kw-hour. For all in excess of a metered consumption equivalent to 60 hours' use per month of the maximum demand, 3 cents per kw-hour.

There are also quantity discounts beginning with a 10 per cent discount on $50 monthly bills and running up to 50 per cent discount on $1000 monthly bills. This is a very decided reduction from the previous rate, which was 10 cents per kw-hour for the first thirty hours' use per month of the maximum; 8 cents for the next thirty; 6 cents for the next thirty; 4 cents for the next 450 and 3 cents for the last 180 hours per month.

## Floods and Ohio River Power Plants.

The two great floods on the Ohio River the past winter made interesting work for some of the companies owning electric power stations within reach of high water. At Cincinnati the great variation in the height of the Ohio River has heretofore prevented the erection of any great lighting or railway power plants along its banks because of the difficulty of providing for the great variations in the river level, amounting to about 70 ft. Modern engineering can overcome these difficulties, however, and the Union Gas and Electric Company, of Cincinnati, has purchased a site on the river where it will some time in the future erect a large generating station, as it has nearly reached the ultimate capacity of its present plant.

At Covington, Ky., the Cincinnati, Newport & Covington Light and Traction Company has a power station on Lick Run, one of the short tributaries of the Ohio. This plant was uncomfortably near the high-water mark of recent floods, and is slightly below the highest recorded water. It is difficult to understand why in years past power houses and other important buildings would be started on such low levels as flood records show will be surely, sooner or later, under water. The Covington plant was one of those started many years ago and gradually enlarged into a very modern and economical station. While the recent high water did not get into the engine room floor, it flooded all pits by backing up through the sewers. Mr. C. W. DeForest, chief engineer of the company, is planning the following changes to take care of future floods: All sewers and similar openings from pits and wells will be tightly cemented up and pits made as near watertight as possible. The drainage system of the power plant will be changed so as to discharge into a watertight well. From this well there will be a sewer opening controlled by a valve so that when the water in the run is at ordinary height, the well will drain itself. When the river rises so that the water is above the level of this sewer, a centrifugal pump of large capacity will be used to lift the water out of this well.

At New Albany, Ind., the United Gas and Electric Company has a power house on the Ohio River, the basement of which had about 3½ ft. of water in it during the recent floods. The condensing apparatus of this plant is on the main floor, so that the principal thing to be troubled by high water was the oil-pumping system, as the oil pumps for the step bearings of the turbines, as well as for the other oil supply were in the basement below the water level. This oil-pumping apparatus was kept in operation and the station was not shut down. A crib of matched plank was built around the oil pumps and with cracks caulked as tightly as possible. The employees used a raft to get to the oil pumps. The steam siphon kept the space inside the crib free from the water which leaked in. Another point at which a steam siphon had to be used was the fly-wheel pit of one of the engines. The greater part of the output of the plant is generated by Curtis steam turbines. Although this fly-wheel pit was in solid cement, carefully constructed with no apparent chance for the water to seep in, it was not watertight and a steam siphon had to be used there also.

## Great Western Power Company's Operations.

The plans of the Great Western Power Company for the development of power on the Feather River are advancing very favorably, according to Frank L. Brown, of Brown, Wilson & Company, who are backing the project. The ultimate purpose of the company is to develop 420,000 horse-power from the stream, the largest in volume, as it is the most constant in flow, of all the affluents of the Sacramento River. The company is now employing 500 men at Great Bend, 20 miles north of Oroville, in completing a large tunnel, through which the entire flood of the river will be conducted. In this vicinity the Feather River describes a horseshoe about 15 miles in circumference, and at the lowest point the two channels approach within 15,000 feet of each other.

The descent of the river is very rapid, and in the 15 miles falls 525 ft. Some years ago the Great Bend Mining Company constructed a tunnel through the neck in an ambitious attempt to exploit the placer gold in the channel of the river, but after spending $1,250,000 the plan was decided as impracticable and afterward abandoned. The tunnel referred to had been driven by the mining company for 12,000 ft., or within 3000 ft. of the proposed point of discharge.

Recently the properties of the mining company were acquired by the Great Western Power Company. The tunnel across the neck, as driven by the mining company, was only 200 sq. ft. in dimensions, and the vertical fall at outlet was only 325 ft., but by enlarging the dimensions of the tunnel to 350 sq. ft. and changing its direction so as to discharge lower down stream, a vertical fall of 525 ft. was gained. The company is now lining the interior with concrete. On the bank of the river, 525 ft. below the outlet of the tunnel, the power plant is building. It is estimated, a year hence, 90,000 kilowatts of power will be ready for distribution. The machinery has been ordered and will be in place as soon as the power house is ready to receive it. From Great Bend to San Francisco Bay the distance is 180 miles. Energy will be transmitted over copper wire cables, supported by steel towers, fixed in concrete, seven towers to the mile.

The greater project of the company is the development contemplated in Plumas County, at a point about 50 miles northeast of the Great Bend plant, where the Feather River and its tributary, Butte Creek, will be used for power. The company has contemplated the purchase of 24,000 acres of land on both streams, with the view, after constructing large dams, of creating reservoirs, available in time of drought. The reservoir at Big Meadows will be the largest artificial body of water in the State, about 21 miles in length and in places 125 ft. deep. It will be capable of storing water enough to run the plant for upward of a year. The reservoir on Butte Creek will be smaller, but very capacious. At these two plants, the company's engineers declare 225,000 kilowatts of power can be maintained with a fall of 1950 ft.

Funds for the entire project have been provided by the sale of $25,000,000 of the bonds of the company. The president of the Great Western Power Company is Edwin Hawley, who is also a director of the Western Pacific Railroad, president of the Iowa Central and director in many other financial and industrial corporations.

Within a year the power company will have 90,000 kw of power ready for distribution from Great Bend, and in two years more 225,000 additional from the upper Feather.

## Public Utility Corporations and Municipalities.

In conformity to the recommendation made by Governor Edward G. Stokes to the New Jersesy Legislature, a committee, consisting of Mr. James H. McGraw, as chairman, and Messrs. A. B. Leach and A. N. Barber, was appointed last winter to investigate and report upon the feasibility of a law providing for a division of the profits of public utility corporations with the municipalities which may grant such corporations permission to do business therein. Investigations by the committee revealed the fact that only two states, namely, Massachusetts and Rhode Island, have passed laws with the above objects in view. In each of these states the law provides for a division by street railway companies of dividends in excess of 8 per cent. In Massachusetts the law has not been productive of revenue, while in Rhode Island the total amount collected was less than would have been obtained under a gross earnings tax equal to that levied last year upon the street railway companies in New Jersey; and the committee expressed the opinion that the excess dividend tax might be evaded by slight increase of capitalization by an operating company.

In addition to the facts just mentioned, the committee, in its report submitted on March 25, outlined the following fundamental objections to the proposed plan: (1) Owing to the different degrees of capitalization representing property values and affecting dividend rates, the law would be unequal as a rule of taxation. (2) It would not be productive of revenue except in isolated cases, unless the rate of dividend allowed the corporation be placed below that at which money is ordinarily invested without risk. (3) It would place at a disadvantage independent companies as compared with those leased and operated by holding companies. (4) It would, except in populous centers and in its application to very valuable grants, prevent a sufficient return to attract the investment of capital in limited franchises and tend to give monopolies to corporations now holding franchises granted in perpetuity.

The committee held the opinion that the function of public utility corporations is not so much that of an agent of the municipality employed for the purpose of increasing its revenue as it is that of a servant of the public to which certain functions have been relegated; and thus they exist for the purpose of supplying needed service as efficiently and cheaply as possible. It was suggested that the important question of improving and developing the service given by the public utility corporations might properly be made a subject of study and investigation to the benefit of the people.

## Death of Prof. E. Hospitalier.

We regret to announce the death of Prof. Edouard Hospitalier, which occurred recently at Paris. Prof. Hospitalier was widely known in this country, both through his writings and personally. As a delegate to the Chicago International Electrical Congress and to every similar congress held in Europe the past 25 years, he made many American acquaintances and warm friends, often remarking that he found himself more in sympathy with Americans and American ideas than with any other nationality.

Prof. Hospitalier was born in 1852 and was educated at the Ecole des Arts et Metiers at Aix and the Ecole Centrale of Paris, graduating from the latter as mechanical engineer. In 1879 he became editor of *La Lumière Electrique*, in 1883, editor of *L'Electricien* and in 1891, founded *L'Industrie Electrique*, of which he was editor until his death. In 1882 he was appointed professor of electrical engineering at the Ecole de Physique et de Chimie Industrielle of Paris, which chair he occupied continuously up to the time of his death. He took an active interest in the Société Internationale des Electriciennes, of which he was one of the founders and at different times was elected to every office in the society from secretary to president.

Prof. Hospitalier was particularly interested in establishing an international system of electrical nomenclature and notation, and it is to him that electrical science and engineering is largely indebted for the uniformity of use throughout the world of standard symbols and nomenclature. He also strongly advocated the adoption of the Henry at Chicago in 1893, and of names for magnetic units in Paris in 1900.

He was the author of a number of books. Of these "Les Principales Applications de l'Electricite" was the first satisfactory treatise on modern electrical applications, and his "Formulaire Pratique de l'Electricien," first printed in 1883 and revised annually, has always been in many respects the best electrical manual printed in any language. He was the inventor of the ondograph for recording alternating-current wave forms, and the manograph for indicating internal combustion engines. He was much sought for membership on committees dealing with scientific matters, and on juries of international and other exhibitions. In 1888 he was made an officer of the University of France and became a Chevalier of the Legion of Honor in 1900. In 1899 he was made commander of the Order of the Crown of Italy.

## Cleveland Meeting of Independent Telephonists.

A joint session of the officers and executive committee of the International Independent Telephone Association and representatives of large telephone operating interests was held in the office of J. B. Hoge, president of the organization, at Cleveland, O., on Monday and Tuesday of last week. The proceedings were mostly in the form of a discussion of the points of interest involved in different sections of the country, but information was secured from some of the members after the adjournment, going to show that the movement is growing rapidly and is securing a foothold in all parts of this country and in some sections of Canada.

President Hoge presided, and J. A. Harney, assistant secretary of the association, and in charge of the headquarters in Cleveland, acted as secretary. The following were present: E. L. Barber, vice-president and general manager of the Independent Telephone Company, of Chicago; M. B. Overly, of Louisville, Ky., representing Southern interests; W. B. Woodbury, general manager of the Home Telephone Company, of Detroit; Charles E. Sumner, of Portland, Ore., representing the independent interests of the Northwest; J. G. Splane and Robert C. Hall, president and treasurer respectively of the Pittsburg and Allegheny Telephone Company, Pittsburg; Senator C. W. Kline, Hazleton, Pa., representing Pennsylvania and New Jersey; Chas. S. Norton, of Indianapolis, representing the Indianapolis Telephone Company and the New Long Distance Telephone Company which controls extensive toll lines in Indiana; James S. Brailey, Jr., president of the United States and Cuyahoga Telephone Companies, of Cleveland and head of the Ohio Syndicate; C. Y. McVey, general manager of the United States and Cuyahoga Telephone Companies; E. W. Moore, of the Everett-Moore and Ohio Telephone Syndicates, J. B. Hoge, president of the International Association, and J. A. Harney, assistant secretary of the same organization.

In reply to a question as to the object of a meeting at this time, President Hoge said: "The last meeting of the executive committee was held in Chicago in October, and since that time important franchises have been granted the independent people in various parts of the country, notably at Omaha, Denver, Milwaukee and Boston. All of these places have seen a determined fight on the part of the Bell Company to keep the independents out of the field. At Denver and Omaha the matter was submitted to a popular vote at the last election, the results being overwhelmingly in favor of the independent companies. The independent victory at Boston is especially important, Boston being the home of the Bell Telephone Company. An important feature of the independent development during the past few months has been the completion of arrangements to provide full facilities at Chicago and Detroit for connections

with the independent lines. The provincial government of Manitoba, Canada, at the last election was sustained in its policy to establish telephone systems to compete with the Bell Company in Canada, the service, rates and treatment of that company being altogether unsatisfactory to the people of that province. The Manitoba Government will at once begin the construction of telephone plants which will connect with the independent lines in the United States. The great progress of the independent movement recently has made it advisable to call this meeting of the association officers and large operating interests to consider plans for carrying on the association work along broader lines. Arrangements have been made to provide sufficient additional funds for that purpose, and a great deal of new work will be undertaken by the association in the near future. The time and place for the next convention was also considered. While no definite decision has been reached, this will probably be held in Chicago early in June."

The public generally has an idea that the independent interests of the country are being formed into one great company or merger, but this seems to be a mistake common to those who do not take the pains to get at the bottom of matters. On this point Mr. Hoge had the following to say: "Even if such a merger were possible we would not consider it advisable. Our aim is to keep the independent interests together in a compact organization for mutual advancement. Consolidations are constantly being made here and there throughout the states with a view to greater economy and efficiency, but beyond a certain limit such consolidations are not practicable. The telephone business is peculiar; local control and management are essential to obtain the best results; that and local ownership of securities have been the chief sources of strength of the independent companies. Our present organization includes all of the independent companies in the United States through their state associations, and the independents of Canada through the Canadian Independent Telephone Association. At present there are over 7000 independent companies in the United States, operating in approximately 13,000 cities and towns, with about 3,500,000 telephones connected with their systems. There is approximately $350,000,000 invested in these properties. The movement in Canada is of comparatively recent growth, but already there are in the neighborhood of 15,000 independent telephones, a growth of over 100 per cent during the past year, and next year will show a growth of over 200 per cent."

Speaking of the Michigan situation, W. B. Woodbury, general manager of the Home Telephone Company, of Detroit, said: "We have been actively at work for the past six months, and have at present four steel buildings in course of construction, representing an investment, including real estate, of over $250,000. Half our local pole lines in Detroit are up, and about one-third of our subway is completed. We are now at work stringing wire on our completed pole lines. The total investment in the city of Detroit will exceed $3,000,000. In addition to the local work, our company is building 300 miles of toll lines, carrying about 4,000 miles of circuit. This long-distance work represents an investment of over $1,000,000. We will connect with all the independent plants in Michigan, Indiana and Ohio, and through arrangements with the United States Telephone Company will have special facilities for the Cleveland business. At present we have over 9100 first-class contracts signed up for service, and will begin operations the latter part of this year with 15,000 subscribers. I might add that our property is fully financed, every cent required being at our immediate disposal."

Senator C. W. Kline, of Hazleton, Pa., vice-president of the Consolidated Telephone Company, of Pennsylvania, and interested in the Inter-State Telephone and Telegraph Company, said that telephone matters are progressing satisfactorily in eastern Pennsylvania, as well as throughout the remainder of the state. So far as he could learn, there is no incorporated city or town in that state that has not granted a franchise to an independent company. The Keystone Telephone Company, of Philadelphia, is operating 25,000 telephones and growing at the rate of 750 per month. In the matter of toll line, the development is very satisfactory.

Mr. Charles E. Sumner, head of a syndicate which is developing the Northwest, spoke of the work there in the most encouraging manner. Companies have been organized and financed entirely with Pacific Coast capital to build exchanges and long distance lines throughout Washington and Oregon, and several million dollars will be spent by them before the close of the year. Mr. Sumner said: "We have an automatic plant in Portland almost completed and at present are building Spokane, Walla Walla, Tacoma, Bellingham and other cities throughout the two states. At both Portland and Spokane we received our franchises by popular vote. Seattle already has an independent plant with 10,000 phones in operation and is gaining every day. About a year ago the citizens of this city, at a public mass meeting, decided to order out the Bell phones from their places of business and the independent company has been kept busy replacing these instruments with its own. The prospects for independent telephony are very promising in the Northwest. Independent service is popular and the people are very progressive and, as a whole, prosperous, and insist upon having every modern convenience."

On account of the situation that existed in Chicago for several years, the explanation made by Mr. E. L. Barber, vice-president and general manager of the Independent Telephone Company, of Chicago, is interesting. Within a few months, he stated, his company will be in position to give all the independent companies connection with that city. All the money needed to fully develop the city has been secured. Cleveland will be given connection with Chicago over the lines of the United States Telephone Company by way of Fort Wayne. "We shall have direct lines to Milwaukee, Omaha, Kansas City and St. Louis," said Mr. Barber, "and will connect with Buffalo, Pittsburg and other Eastern cities over the United States lines. The long-distance companies in the states surrounding Chicago are pushing their construction to be able to connect with us the moment we are ready to receive them. The development of Chicago is of great importance to the independents."

Mr. Frank L. Beam, president of the Ohio Independent Telephone Association, is enthusiastic over the progress that has been made within the past year. He said the situation could hardly be better. The tabulation from the various counties, just completed, shows a gain of over 21,000 telephones during the past six months. The total number at present is 269,220 and the prospects for the coming year are much better than twelve months ago. Of his work as president and manager of the association Mr. Beam said: "My duties involve a great deal of traveling throughout the state, and everywhere I go I find the independent companies in good strong financial condition, the majority of them paying satisfactory dividends on their stock. Many of the companies are earning dividends but putting the money into new construction. The toll-line development has been very extensive this year and millions of dollars will be spent in this state alone in providing additional toll lines needed. Extensive switching stations are now being installed at Bucyrus by the United States Telephone Company."

Speaking of the Central Home Telephone Company, of Louisville, Ky., Mr. M. B. Overly, the general manager, said that the company was organized to take over practically all of the independent exchanges and long-distance lines in southern Indiana, Kentucky, Missouri and Tennessee. The company is now engaged in building heavy copper toll lines through to the Gulf of Mexico, all of it being almost completed to Birmingham now. The right of way has been secured for the remainder. Being the president of the Kentucky Independent Telephone Association, Mr. Overly keeps in close touch with affairs. He says that every company in the state is in a prosperous condition, and that the independents in the South generally have been aroused to activity by the progress that has been made in the East. The prospects for building exchanges at Nashville, he thinks, are good. A new exchange has just been completed at Mobile and is making good progress.

Mr. Charles S. Norton, secretary of the Indiana Association, said that rapid progress had been made, especially in the toll line development, in his state. The facilities of all companies

are taxed to supply the toll line service required. The prospects are good for securing a franchise at Evansville, the only town of any size in the state that does not have the independent service. According to a canvass of the state just made, Mr. Norton said, there are 187,488 telephones connected with independent lines, and 72,219 connected with the Bell system, including their sub-licensees.

## Cost of Alternators for Various Voltages.

Due to a typographical error in our report of the discussion of Mr. Behrend's A. I. E. E. paper on 22,000-volt generators, it was stated that Mr. Torchio had given estimates of the cost and efficiency of generators for a 40-kw equipment, when in reality the estimates related to a 40,000-kw equipment. On account of the fact that the conditions upon which the estimates were based were very special, we give herewith a more complete report of Mr. Torchio's remarks. For a certain large water power proposition in which the conditions seemed pre-eminently to warrant the use of 22,000-volt generators as the total length of the transmission line was about 15 miles, with a total generating capacity of from 30,000 to 40,000 kilowatts, manufacturers were asked to make a preliminary study for machines of 2250 kilowatts, 25,000 volts, three-phase, 60 cycle, 112½ revolutions. Under these specific conditions it was found that the costs and efficiencies of generators for different voltages would be approximately as follows:

| VOLTAGE OF ALTERNATOR | RELATIVE COST | EFFICIENCY IN PER CENT. |
|---|---|---|
| 2300 | 100 | 96.00 |
| 15000 | 130 | 95.25 |
| 25000 | 155 | 24.20 |

From the above it would appear that as far as cost and efficiency are concerned there would be hardly any difference between the low-voltage generator with step-up transformer and the 25,000-volt generator. On the other hand, if step-up transformers are used, great savings can be made in the copper and transmission line by raising the voltage higher, say, to 14,000 volts, which voltage can now be made as entirely safe to operate as the lower voltage, and probably in connection with oil transformers, safer than with 25,000-volt generators.

## CURRENT NEWS AND NOTES.

*A CORRECTION.*—Owing to a misprint in the article on "Electrical Journalism in 1874," in our issue of March 2, the date of the last issue of *The Operator* is given as September 9, 1883. The correct date is September 19, 1885.

*STREET RAILWAY CONVENTION.*—The annual convention of the American Street and Interurban Railway Association will be held at Atlantic City, N. J., October 14 to 18 inclusive. The exhibit of apparatus will be made on the Steel Pier.

*IOWA ELECTRICAL ASSOCIATION.*—The programme of the seventh annual convention of the Iowa Electrical Association at Clinton, Ia., on April 18 and 19 includes the following items: "Cost of Operation per Dollar of Income," by Prof. L. B. Spinney, of Ames; "Central Station Economics," Gus Lundgren, of Cherokee; "Increasing the Central Station Day Load," E. S. Callahan; "Manufacture of Ice," Rufus Lee, of Clarinda; "Co-operation," J. R. Crouse; "Central Station Heating—Steam and Hot Water," W. H. Schott; "Selection of Steam Engines," H. E. Chase, of Minneapolis; "Gas Producer Engines," Prof. G. W. Bissell, of the Iowa State Agricultural College at Ames; "Electric Distribution Systems," by Prof. A. H. Ford, of the Iowa State University.

*RAPID STATION CONSTRUCTION.*—The Dayton, O., Citizens' Electric Company began the construction of a power house and distributing system in September, 1906. On March 24 it began to operate its first 1000-kw Westinghouse-Parsons turbine unit. The station is designed for 6000-kw. It is a concrete building with brick front. The company in that time installed also a large part of its distributing system. This is the company which is about to compete with the Dayton Lighting Company for central station business in that city. The construction and management have been under the charge of Mr. Cyrus E. Mead, vice-president and general manager. Considering the difficulties during the past nine months in getting deliveries of all kinds of construction material and apparatus, this construction record is certainly a remarkable one.

*NEW CHICAGO TROLLEYS.*—Mr. Bion J. Arnold, the city's expert, in general charge of the work for at least three years to come, says: "The Chicago City Railway will reconstruct thirty-four miles of cable track and sixty miles of electric track. Union Traction will reconstruct forty-eight miles of cable and ninety miles of electric track. The South Side will get 800 new cars and the North and West sides 1200 new cars. A decision will soon be made whether it is necessary to build new power houses, depending on the ability of the companies to purchase energy at advantageous figures." The cost of these power houses would be $10,000,000. Mr. Arnold will represent the companies as well as the city, and his salary will be $30,000 a year. The city will also have a special engineer under Mr. Arnold. The companies name the third engineer on the new supervising board. The city's engineer will receive $100 a day when engaged in actual work.

*NITROGEN FROM AIR.*—The Chemical Society of Washington, one of the branches of the National Chemical Society, was addressed on April 1 by Dr. A. Frank, Jr., of Berlin, on the uses, qualities and methods of manufacturing calcium cyanamid or lime nitrogen, as developed by Dr. A. Frank, the father of the lecturer, and Dr. Nikodem Caro, both of Germany. The Deutsche Bank, of Berlin, and the Siemens and Halske interests, the electrical manufacturers of Germany, have been the financial supporters of the experimental and commercial efforts in connection with the production of lime nitrogen. Dr. Frank also discovered and developed the application of potash as a fertilizer and to-day it is one of the great industries of the world. Last year 350,000 tons of potash salts were imported into the United States from Germany. The American Cyanamid Company, of New York, has secured the rights for the production of lime nitrogen in the United States and is preparing for its manufacture in this country on a large scale.

*DEDICATION WEEK.*—A number of details have already been given in these pages as to the exercises connected with the dedication of the Engineering Societies Building. The two chief days are April 16 and 17. The dedication will take place at 3 p. m. on April 16, in the main auditorium, invitation by special ticket. In the evening at 9 there will be a large general reception, when the whole building will be thrown open. On the afternoon of the next day, there will be a public meeting, at which congratulations will be presented by kindred societies, etc., from all over the world. Prof. A. G. Bell will receive the John Fritz gold medal, and special commemorative gold plaques will be presented to secretaries Pope, Hutton and Raymond. These constitute the exercises proper; but there will be several supplementary events. On Monday, April 15, at the Building, the Electrical Engineers will listen to a paper on the Rowland telegraph system, by Mr. L. M. Potts, and this gathering will be presided over by Sir W. H. Preece, K.C.B., F.R.S., past president and representative of the Institution of Electrical Engineers of England. The Mechanical Engineers will be in session during the week, and on Thursday evening will have a paper by Brig. Gen. W. Crozier, U. S. A., on the ordnance department as an engineering organization. The Mining Engineers will be in full convention during the week and on Thursday afternoon will have a very interesting paper by Mr. H. T. Hildage, on the excavation and tunnel work now going on around New York City. On Friday evening at Madison Square Garden concert hall they will round out the week with a smoker and vaudeville, for which a special stein has been making bearing the badges of the three founder societies. Tickets for this are $2. All these exercises are open in common to the members of the societies.

*THE TROLLEY IN CHINA.*—A Hongkong merchant, Mr. Yip Yin, of the firm of Wah Yik Company, has applied for permission to float a company with a capital of $1,300,000 to build an electric tramway at Kongmoon, in Sanwui district.

*AID TO A SCHOOL.*—The Columbus, Ga., Power Company has given $10,000 to the secondary industrial school of that Southern city in the shape of free electrical energy. The gift is based on a consumption of about $2,000 a year for five years, and on 2-phase, 60-cycle current. The installation to be operated is of about 75 horsepower.

*WIRELESS IN TURKEY.*—U. S. Consul-General Edward H. Ozmun reports from Constantinople that the Imperial Turkish Government has decided to establish several wireless-telegraph stations in the Empire. At present there are only two, at Kelemish, on the Anatolian coast, and Derna, on the coast of Tripoli, in Africa. The Government will engage two specialists in Europe for training the staffs of the projected stations.

*WOMEN TROLLEY CONDUCTORS.*—Mr. Newton W. Bolan, superintendent of transportation of the Public Service Corporation of New Jersey, made an address last week at Orange on the occasion of the formal opening of the Dewey Park trolley barns and offices, in which he declared that he would have women conductors were it possible. The remarks were applauded by 250 trolley men and their wives, although the basis of their enthusiasm is not quite clear.

*CONTRACTORS' CONVENTION.*—Messrs. J. C. Hatzel, F. J. Miner and W. I. Patterson, National Committee, have issued a notice to the effect that the National Electrical Contractors' Association of the U. S. will hold its seventh annual meeting in New York City, July 17, 18 and 19 inclusive. Even at this early date, all indications point to this convention as being the most largely attended, and probably the most interesting and entertaining thus far in the history of this growing and influential association.

*FIRE AT M'GILL UNIVERSITY.*—The Macdonald engineering building, the gift of Sir William Macdonald to McGill University, Montreal, was completely destroyed by fire April 5. The total loss is stated to be about $750,000, upon which there is an insurance of $420,000. The building was five stories high. It contained the famous Renleaux collection of kinematic models and many instruments and apparatus that cannot be replaced. In it were thoroughly equipped electrical and magnetic laboratories, dynamo rooms, lighting plant for the university, accumulator room, laboratories of mathematics, dynamics, mechanics, geodesy, modelling, testing and thermo-dynamics. The structure was opened by Lord Stanley in 1893.

*ELECTRICITY FOR ADRIANOPLE.*—U. S. Vice-Consul-General William Smith Lyte, of Constantinople, makes the following report on proposed improvements at Adrianople: "An application for a concession for the supply of electricity which was made to the local authorities has been favorably reported upon. The ministry of public works has, however, decided to invite tenders for the work. Adrianople, the capital of Roumelia, for some time the capital of the Empire (1360-1455), is at the present day less populated than Smyrna and Salonica and of less commercial importance than these cities. It has a population of over 80,000 inhabitants. Adrianople has several factories for making cloths, hand towels, and silk spinning, also flour mills, distilleries of water and attar of roses. Its principal exports are silks, cocoons, grain, wool, and skins. Its imports are cotton, woolen and silk stuffs, leathers, provisions, sewing machines, etc."

*PITTSBURG INSTITUTE FUNDS.*—The Pittsburg Carnegie Institute for technical education, etc., is to be opened and dedicated this week. At a meeting of the board of trustees of the Carnegie Institute last week, a letter was received from Mr. Carnegie, in which he announced a gift of $4,000,000 in 5 per cent United States Steel Corporation bonds as an addition to the $4,000,000 with which the Carnegie Institute is already endowed, and $1,000,000 in cash and $1,000,000 in the same kind of bonds to the Carnegie Technical Schools. The income of $250,000 per annum is to be applied, says the letter, to support the technical schools, art department, museum, music hall, librarians' schools, and such other classes and schools as may be established in connection therewith. "I think the technical schools rank first in practical importance," continues Mr. Carnegie, "since they chiefly instruct the sons and daughters of workers in the mills and factories who labor through the day and seek instruction at night. Their success under Dr. Hammerschlag has been phenomenal, and they should, and no doubt will, receive your unfailing support." A pension fund for all the employees of all the Carnegie institutions is to be established out of the endowment fund. The gift makes a total of $23,600,000 which Mr. Carnegie has given to Pittsburg.

*SIR W. H. PREECE, K.C.B., F.R.S.,* is once more in this country after an absence of ten years, and expresses himself as greatly pleased with the technical and industrial advances that he notes on every hand. Last week he visited in this city the Waterside stations of the New York Edison Company; the powerhouse of the Interborough Company; the telegraph companies, the *New York Times* and the Engineers' Club. This week he will inspect the system of the New York Telephone Company, and then proceed to the opening of the Carnegie Institute in Pittsburg. Next week as the official representative of the Institution of Electrical Engineers of Great Britain he will participate in the dedication of the Engineering Societies Building, presiding at one of the meetings of the American Institute of Electrical Engineers. He will also participate in the great Peace Congress and attend its banquet. While here, Sir William is investigating the subject of reinforced concrete in connection with the great new Post Office buildings to be erected at St. Martin's-le-Grand, London, where the Government has some eight acres now available; and he is visiting some of the notable structures here of that character. Last week he inspected the new eleven-story building of the McGraw Publishing Company, on West Thirty-ninth street, the largest example of this modern method in Greater New York. Sir William will return home before the end of the month, but hopes to make a trip out again in August on the big new turbine Cunarder.

*THE CHICAGO SITUATION.*—With regard to the recent mayoralty election in Chicago, the *New York Times* says: "The congratulations of the country and its gratitude, too, are due to the voters of the city of Chicago who yesterday, after a furious campaign in which the personality, the ambitions, and the methods of William R. Hearst had become the dominant issue, rejected Dunne, the Hearst candidate, and elected Mr. Busse mayor by a plurality of from 15,000 to 18,000. The mad and mindless rage against everything that is and everything that decently ought to be that has recently inflamed the passions and beclouded the judgment of so considerable a number of voters in this country had manifested itself in its most dangerous and repulsive form in this Chicago election. The reputation of the people of that city for soberness and steadiness was really at stake. They have declared themselves with positiveness as a sane and civilized community. Mayor Dunne and his 'immediate municipal ownership' policy are cast aside. He has been a failure. He was unable to fulfill his rash promises; he showed himself incapable of offering any solution of the traction problem which has long been the leading municipal issue. He had vetoed a well-planned, businesslike, and promising readjustment of the relations of the city to the traction companies, passed by the Board of Aldermen, and this plan submitted to the vote of the people yesterday has been ratified. The traction lines will be operated by the companies on short-term franchises, the city having the privilege of purchase at a stated sum. Chicago has repudiated municipal ownership and relegated to the rear those who advocated it."

*RAILROAD FREIGHT RATES.*—At a time when the steam railroads are threatening an advance in freight rates, it is interesting to note that the National Electric Light Association, through a committee of which Mr. E. H. Davis is chairman, is moving to secure a lower classification and a reduction in the freight actually paid. Mr. Davis is now canvassing the electrical manufacturers on the subject.

*MUNICIPAL MARKETS.*—The Mayor of Berlin, Germany, in an interview, declares that the municipal market halls are being operated at a loss, and that the question of leasing them to private concerns is being seriously considered. There are fifteen of these halls. The question was recently discussed by the City Council. The present situation is attributed to the lower prices at which department stores are now selling foodstuffs.

*THE LIFTING MAGNET* is in use at the Greenville yards of the Pennsylvania Railroad, New Jersey, to handle rail and scrap iron, etc. They made a test over in the yards the other day to determine the difference between the old way and the new way. Six men were put to work unloading one car of wheels, while the magnet, which is attended by four men, went to work on a load of exact size, material and weight. The magnet loaded and unloaded its car in one hour, while the six men labored manfully at extra pressure for a half day and were just through. Other magnets have now been ordered, and will soon take their place in the freight yards.

*TELEGRAPH PAY ROLLS.*—In regard to the recent increase in the salaries of telegraphers and in telegraph tolls, *Bulls and Bears* says: "The public enters without pretense of cheerfulness upon the task of paying an increase in the pay rolls of the Western Union and Postal Telegraph companies. The tolls of the two great companies have been raised on an average of about 33 per cent. Between the larger commercial cities the advance is 20 to 35 per cent. On the same volume of business done last year this would mean an increase in the total revenues of the Western Union of between $6,000,000 and $7,000,000, or at least double the amount involved in the raise in wages which has gone into effect. The telegraph companies are alive to the advantages of capitalizing their misfortunes and additional burdens and making money by the operation."

*POWER FACTOR IMPROVEMENT.*—Use has frequently been made of condensers for absorbing the leading component of wattless current in order to compensate for the lagging component taken by various inductive devices such as induction motors or constant current transformers. When a condenser is connected directly across the circuit the desired improvement in the power factor is not always obtained, because the condenser tends to accentuate the harmonics in the e. m. f. wave, that is, it draws a large component of wattless current which is not of the fundamental frequency. In a patent issued April 2 to Mr. M. O. Troy, it is claimed that the objectionable actions of the harmonics may be eliminated and the beneficial effects retained by including in the circuit of the condenser an inductance coil sufficient to damp out the objectionable harmonics.

*ROENTGEN RAY DANGERS.*—A special cable dispatch from Berlin, of April 6, states that at a meeting of the German Röntgen Society last week a resolution was passed declaring that it was advisable to prevent unlicensed persons from making diagnoses by means of the rays, owing to the danger to life. Prof. Krause, of Breslau, gave an address on the influence of the rays on the blood of human beings and animals, and Dr. Schmidt, of Berlin, on the influence of the rays on embryos. Dr. Köhler, of Wiesbaden, produced kinematograph pictures illustrating the breathing of healthy and sick persons. This is the first time the inner action in the breathing movements has been demonstrated in this manner. The part played by the diaphragm and the ribs was indicated clearly, as was the palpitation of the heart. The condition of the stomach in a case of cancer was shown also by the same method. If the salts of bismuth, either the subnitrate or subgallate, are administered to the patient before the pictures are taken they are reflected clearly in the Röntgen pictures. It has been proved that the action of the rays is of immense value to such patients.

*UNNECESSARY NOISES.*—Mrs. Isaac L. Rice, president of the Society for the Suppression of Unnecessary Noises, has an article in the April Forum on "Our Most Abused Sense—The Sense of Hearing," in which she pleads for the suppression of all unnecessary noise, not for the sake of invalids alone, but to promote the welfare and happiness of everybody. She details the useful work of the Society and its plans for the future. The new crusade, which is actively under way, aims at the suppression of such unnecessary noises as these: The blowing of whistles on factories, trains, and boats; the clanging of bells of trains, trolley cars, churches and clock towers; the loud advertising of street vendors with cries, whistles, horns and bells, and of amusement parlors with phonographs, etc.; noises due to defective mechanism, such as the pounding of flat wheels and the sounding of improperly lubricated motors; the rattling of loose parts of wagons; noises due to badly paved streets; free exhaust of steam from shunting engines in freight yards, and cries and street brawls. Mrs. Rice says: "Quite recently William M. Wood, president of the American Woolen Company, of Massachusetts, openly favored abolishing bells and whistles on all the mills in his State, on the ground that great benefit would result to the sick. Prof. Morse has already cited cases of large industrial concerns, like the Pope Manufacturing Company and the Natural Food Company, of Niagara, which use neither the whistle nor substitutes for it. Can anything be more pathetically absurd than a case cited of a file factory, employing a man and two boys, where a whistle was blown that not only disturbed the entire neighborhood, but also awakened invalids in the next county?"

*MUNICIPAL MONOPOLIES.*—Mr. James Bryce, ambassador from England, speaking in Chicago last week before the Commercial Club on the modern city in relation to the State, said: "Much depends on whether the particular work to be done is in the nature of a monopoly. For instance, the supply of water is almost of necessity a monopoly. You cannot have a number of water companies undertaking to supply each citizen by their own pipes. Still less can you have rival street railway companies laying down their rails in the same streets, because there would not be room. This must be a matter either taken over by the city or handed over to one corporation, which would become a monopolist, and at least for one particular part of the city. And the same thing is true of lighting. Now, where there is a monopoly, it is strongly urged in England that the profits which a monopoly may earn and the increased value which the growth of a city gives to such a monopoly as that of street transportation ought to belong to the public. The financial results of some branches of municipal work are much disputed, and to present general conclusions on the subject would be at this moment premature. This much, however, may be said. It is a precondition to the giving to a municipal authority of any control over public work and public utilities not necessarily involved in the varying existence of that municipal authority, that the authority itself should be honest and capable; that is to say, that the administrators should be upright men and intelligent men. Whether they are will depend on the conditions of the particular city. It will depend mainly on the public spirit of the citizens and the sense of civic duty which animates them. If there is a lively sense of public duty and of the responsibility of each individual citizen for the good government of the community; if he gives an honest vote based on his judgment of the character of the condidates; if he watches the conduct of those who administer on his behalf and calls them to strict account for any misdoings, it will obviously be safe to intrust to the municipality functions which otherwise might be desirable to withhold."

*EXHIBITION IN GERMANY.*—A notable exhibition will be opened at Berlin, Germany, in June under the patronage of the Emperor and the auspices of the Technical Society. It will consist of the newest inventions, and among the exhibits will be Lilienthal's airship, the latest inventions in wireless telephony, and Korn's photo-telegraph. A representative of the management is now in the United States, it is stated, for the purpose of trying to induce Thomas A. Edison to be present at the opening of the exhibition. Mr. Edison is at present at his plantation in Florida and is expected to stay there until the end of the month.

*WINCHESTER, MASS., IMMUNE.*—The special committee appointed by Winchester, Mass., to consider the subject of the manufacture and distribution of gas or electricity in their report say that they "are unanimously of the opinion that the town should not at this time undertake to own or control any municipal lighting plant, nor should it, in the opinion of the committee, engage in the manufacture or distribution either of electricity or gas for municipal use, or for the use of its inhabitants." This decision was not unexpected, in view of the experiences of those cities and towns which have municipal plants, and also the fact that Winchester is securing its lighting at reasonable figures, indeed much cheaper than it could manufacture it, from the system of the Edison Electric Illuminating Company of Boston.

*U. S. POPULATION.*—Census Bulletin 71, just published, presents the population returns for 1905 of the fourteen states making an interdecennial enumeration, together with the estimated population of these states for 1904 and 1906, and of the remaining states and territories for 1904, 1905 and 1906. The population of continental United States in 1905, as obtained by adding to the returns of the states which took a census in that year the estimated population of the remaining states and territories, is 82,574,195, an increase over 1900 of 6,579,620, or 8.7 per cent. The estimated population for continental United States for 1906 is 83,941,510, and for the United States, inclusive of Alaska and the insular possessions, 93,182,240. Computed on the basis of the estimate, the density of population of continental United States in 1906 is 28 persons per square mile, as compared with 26 in 1900. The population given for New York is 4,113,043, which some authorities regard as about 500,000 too low. Chicago is just 2,000,000.

*ROAD FOR MOUNT GREYLOCK.*—Definite announcements have been made as to the plans of the New York, New Haven & Hartford Railroad Company for the building of trolley lines from Great Barrington to South Egremont, in Massachusetts, and to Canaan, Conn., the junction point of the Central New England and Housatonic steam railroad lines. The line from Great Barrington to Canaan will closely parallel the Housatonic Railroad, and is part of a more extensive system of parallels, which will be followed by using the upper part of the Housatonic line mainly for express service, leaving local service to the trolleys. The immediate plans in the Berkshire regions also include the building of a cog road to the top of Mount Greylock, the other terminal of which has not yet been definitely decided upon. None of these projects will be affected by the curtailment policy of the New Haven Company regarding extensions. They form part of a large scheme of opening up the Berkshire region as a great summer resort.

*IN ANCIENT DAMASCUS.*—As already noted briefly, on February 7 Damascus celebrated an inauguration of more than passing interest. In the presence of the governor-general of the province and the general in command of the fifth army corps, besides other civil and military officials, notables of the city, and foreign consuls, on that day the new electric trolley and lighting service in Damascus were formally handed over by representatives of the Ottoman Government who had come from Constantinople for that express purpose to the Societé Ottomane Impériale des Tramways et d'Eclairage Electriques de Damas. At first the street car service will cover only the distance from Salhyeh to the Median, some 5 miles through the city from suburb to suburb. Cars were to commence running on March 14. Electric lamps have been installed, and Damascus is now being lighted by 1,000 street lamps, for which the municipality pays an annual rental of 3,000 Turkish lire ($13,200). Besides these, the company has put in more powerful lamps in the Grand Mosque, in the public squares, and in the Serail. Private electric light will soon be introduced in shops and residences. None of the apparatus is American. The installing company is Belgian.

*WIRELESS TELEPHONY.*—A special cable dispatch from Berlin of March 22 says: "Count Arco, in his wireless telephone experiments, has succeeded in obtaining distinct exchanges of words in a tolerably natural voice, at a distance of two miles, by using poles 30 ft. high. Rear-Admiral Manney, who was a delegate of the United States to the International Conference on Wireless Telegraphy at Berlin, and Lieut.-Commander Howard, U. S. N., the American naval attaché here, have been present at a series of private exhibitions of the wireless telephone apparatus, and have been able to talk with each other at a distance of somewhat less than three miles. But the best practical results are attained at two miles or under, with 30 ft. poles. Months ago the Telefunken Company, which is a combination of the Arco, Slaby and Braun interests, telephoned from Nauen to the Technical High School at Charlottenburg, a distance of 25 miles, but the Nauen station was equipped with a pole 300 ft. high. Besides, the words were communicated in alternately high and low notes, and were most difficult to understand. Prof. Poulsen, the Danish inventor, in December last, also succeeded in obtaining exchanges of messages by wireless telephone at considerable distances, but he had the same trouble with high and low tones in rapid succession. Count Arco does not regard his discoveries as commercially practicable at present, though he hopes to construct an apparatus eventually which will take the place of wires in cities, and perhaps in suburban districts."

*ELECTRICITY IN ASIA MINOR.*—Mr. E. L. Harris, U. S. Consul at Smyrna, makes an interesting report on conditions in Asia Minor, and in regard to electricity, says: "The city of Smyrna with nearly 400,000 population has no electric railway, electric light, or telephone. There are cities all over Asia Minor varying in size from 20,000 to 50,000 inhabitants where there are opportunities of getting concessions for electric light and traction. It is strange for American electrical concerns to turn their backs on this field, with the excuse that nothing under a $1,000,000 concession would attract them. There is not an agent or representative of an American electrical concern in this part of the country. Germany and Belgium are ably represented in Smyrna, and they are getting the business. There are many little towns in the interior just now that are awakening to the necessity of electrical plants, and the day when the city of Smyrna will be revolutionized in this respect is not far distant. It is high time that American manufacturers of electrical supplies send out somebody to look at the country. As an example of the apathy with which the American people have regarded this field heretofore it may be mentioned that a young man born and raised in this city, therefore knowing the languages and resources of Asia Minor thoroughly, went to America a few years ago and spent four years in securing a training as an electrical engineer at an American university. Upon returning to Smyrna he made some futile attempts to get in touch with American electrical concerns. Now he is pushing the business of a big German electrical company which engaged his services at once. The people are fast awakening to a realization of the benefits which would accrue to the introduction of steam and electrical enterprises of every description, as well as the wealth which would be theirs if the mines of the country were to be rationally developed."

# Hydro-Electric Plant for British Slate Quarries.

OWING to the fact that in most of the industrial districts in Great Britain where the demands for power are great, the immediate supply of fuel is ample, very little use has as yet been made of hydro-electric equipments in that country. An exception is found in the slate quarrying districts in North Wales, where the cost of coal is very great and the large amount of raw material to be handled renders the fuel bill at a quarry a very heavy item. The Snowdon district is favorably located with reference to the development of water power

FIG. 1.—VIEW OF POWER HOUSE, PIPE LINE AND ANCHOR BLOCK.

on account of the large rain fall, the natural reservoir for storing water, and the great head that can conveniently be utilized.

In the hydro-electric equipment, which it is the object of this article to describe, the water supply is drawn from Lake Llydaw, which stands about 1400 ft. above sea level, and is conveyed by a duplicate pipe line about two miles in length to a power station in Gwynant Valley, the effective head being about 1140 ft.

As regards the possibility of the water supply running short, the chances are very small. At the present rate of supply about 3000 horse-power is utilized in motors and it is found that when there is no rain the lake falls about ⅛ in. per day, at which rate an absolute drought of 720 could be survived. As a matter of fact, it is calculated that when the station is in full operation, with the intake at the lake 30 ft. below the normal water level, the plant could run 180 days without rain.

The intake tunnel is 207 ft. long, and about 50 ft. from the bell-mouths are two 48-in. valves and strainers at the bottom of a double concrete-lined shaft. The water is brought out of the tunnel on the mountain side below the lip of the depression in which the lake lies and thence down the mountain side through a double pipe line to the power house below, as shown in Fig. 1. At the top 5/16-in. rivetted pipe is used; the second length is double rivetted ½-in. pipe, and the lower lengths, where the pressure becomes great are of welded steel tubes varying up to ¾-in. in thickness. The diameter of the pipe lines is 30 ins. on the upper part and 27 ins. on the lower stretch. The pipes are laid on a road formed and ballasted similarly to an ordinary railroad track and raised on heavy 10-ft. sleepers, placed 8 ft. apart and measuring 8 ins. x 10 ins. in section. The pipes are free to slide upon the sleepers, but they are anchored at every few feet throughout their length by means of steel straps carried round the pipe, and embedded in heavy concrete blocks buried in the ground. In addition to these anchors, at five points on the pipe line the pipes are embedded solidly in very massive concrete anchor blocks, four of which weigh approximately 50 tons each, while the fifth which is at an angle some 200 yards above the power house, weighs about 150 tons. Moreover, at sundry points substantial concrete blocks have been set into the banks at the side of the pipe line road, and from these diagonal stays are taken to rings on the pipe line. Thus, it will be seen, that every conceivable precaution is taken to prevent creeping, and, moreover, as the pipe line is inspected every day and marked points aligned with fixed points on either side, it is impossible that incipient mischief from this source should escape detection.

At the foot of the line the pipes turn at an angle into a raceway alongside the power station in which three large sluice valves are fitted so that any one turbine or any combination of turbines can be run from either pipe line. It may be mentioned that either pipe line is sufficient to supply the ultimate capacity of the station. The provision of a duplicate pipe line is by no means standard practice on the continent, but when only one pipe is used it is obvious that any slight repair to the pipe involves a total shut down.

Having passed through the turbines, the water discharges on to the concrete floor of the tail race, whence it flows out and down into Llyn Gwynant. When the governor deflects the jets from the buckets they impinge on a baffle plate, strongly supported by angle irons, and the necessity for the use of

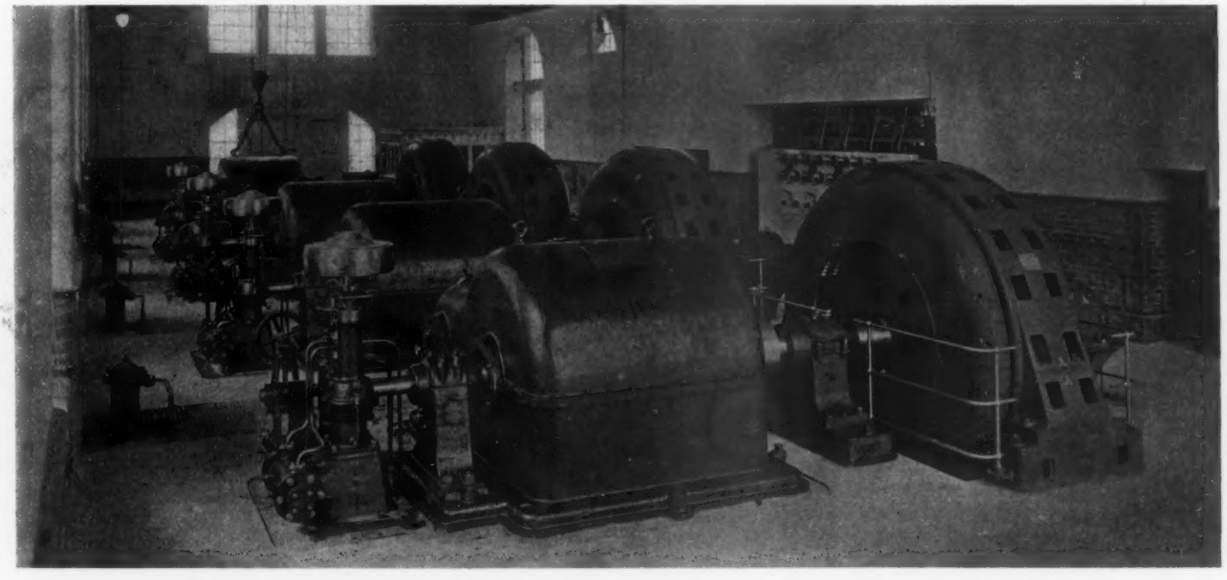


FIG. 2.—VIEW OF INTERIOR OF POWER STATION.

this iron baffle plate will be appreciated when it is noted that owing to the method of governing, it is occasionally subjected to the enormous force of the full jet of water with a head of 1140 ft. What this force amounts to may be gathered from the fact that before these baffle plates were put in position, the jet of water once bored its way through four feet of concrete in a few hours.

The interior of the power station is shown in Fig. 2. At present there are four generating sets, each having a capacity of 1500 kw, but the building, which measures 145 ft. x 50 ft., allows room for two more sets, one at each end. It will be realized from these dimensions that the station building is small in size as compared with a steam-driven one of corresponding output. The Pelton wheels, as mentioned, operate on 1140 ft. head, thus giving a pressure of approximately 500 lbs. per square inch at the nozzles. The adoption of the Pelton type of wheel in preference to any other is due to the fact that it is practically the only water motor that can deal with very high falls. Although its efficiency is rather below that of some turbines suitable for modern heads, with the machines in question an efficiency of 70 per cent has been guaranteed under service conditions. This is worthy of note, as the Pelton wheel is often credited with a much lower efficiency than it really has.

The speed of the wheel is controlled by a differential governor, the effect of which is to deflect the nozzles off the buckets, so that at reduced loads the force of the jet is partially spent upon the iron baffle plate above the tail race as mentioned.

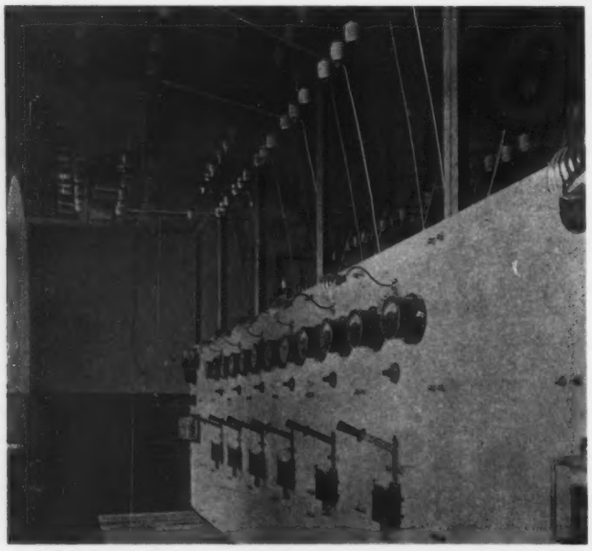


FIG. 3.—FEEDER BOARD, SHOWING CHOKE COIL INSTALLATION.

The governor is also actuated by means of pressure water, the water being filtered, since it operates differentially upon the two sides of a small piston and any foreign body might jam the governor. The normal speed of the sets is 500 r. p. m. Each set has three bearings, and a small outboard bearing for the exciter. All these bearings are water-cooled, and run without appreciable temperature rise.

The alternators were made by Messrs. Bruce Peebles & Co., Edinburgh, who are the sole contractors for the installation. The generators work at a pressure of 10,000 volts. Each has 12 poles, giving a periodicity of 50 cycles per second.

The field poles are wound with the usual copper strip on edge, paper insulated and varnished at the outer surface. The pole cores themselves are cast solid as part of a complete rotating pole ring, which is pressed on to the spider. The pole tips are of solid steel, of special shape and bolted to the pole cores. They serve an additional purpose in retaining the coils in position against centrifugal displacement. The stator armature core is built with partially closed slots. There are a total of 144 slots; that is, four slots per pole per phase. The coils are insulated with pure mica tubes ⅛-in. in thickness and were subjected to a test of 18,000 volts for half an hour and 30,000 volts on the tubes only. The coils are Y-connected, giving 5780 volts to the neutral point.

The exciters are 45-volt, 300-ampere machines, and, as will be observed, are direct coupled to the alternator shaft. They are multipolar machines, and are amply large, in order to cope with the wattless currents which are to be expected on a system supplying power to a large number of induction motors, which are frequently starting and stopping.

The switchboard was made by Messrs. Ferranti, and is not-

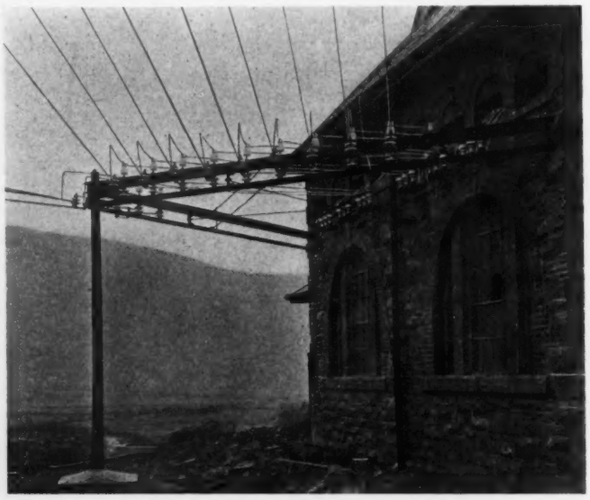


FIG. 4.—HIGH-TENSION WIRES LEAVING THE POWER HOUSE.

able for its simplicity and accessibility. The generator panels face the power equipment. Behind the generator board is the feeder and summation board, Fig. 3, facing in the opposite direction, there being a considerable space between the backs of the two boards, so that the attendant can operate the isolating links, bus-bars, etc., and have access to all connections.

The bus-bars, which form a complete ring, are equipped with isolating links between all generators and all feeders. Thus the station can be divided into two independent parts at any point if necessary. Each feeder panel is fitted with an oil switch having an overload trip coil. The switch is fitted with a bell contact so that in case the trip operates, the bell will ring at the front of the board. Thus it is unnecessary that an attendant be constantly at the feeder side of the switchboard. Ura-

FIG. 5.—DOUBLE-POLE TRANSMISSION LINE.

lite screens are fitted at the back of the panels between all circuits. The bus-bars are carried overhead on massive insulators. There are in all six feeder panels and two summation panels on the feeder board, two blanks being allowed for additional feeders.

Interesting features of the installation are the precautions which have been taken against lightning or other static dis-

charges. Normal small discharges are taken care of by a water leak, which consists of three long glass tubes, one in each phase, through which water runs continually. At the center of this tube, connection is made with the high-tension circuit, and about one-hundredth of an ampere leaks through the water resistance. Horn arresters with choking coils and resistances are utilized as a precaution against lightning. The earth side of the arresters and all metal work on the switchboard are connected to very large copper and zinc earth plates in duplicate, sunk in the bed of the stream which passes the power house. A thoroughly insulated platform is carried all round the switchboard and such necessary adjuncts as high tension unhooking rods for the link switches are supplied in plenty.

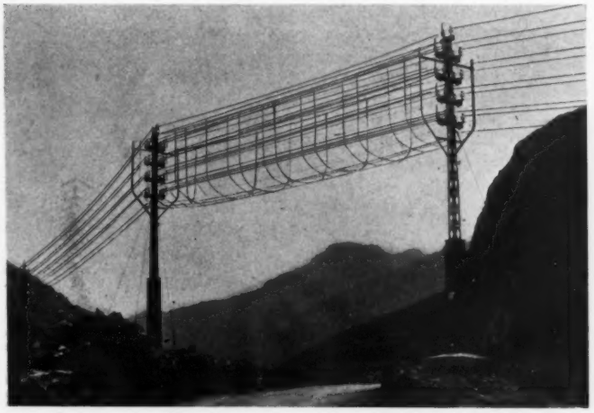


FIG. 6.—STEEL POLES AND GUARD CRADLE AT LLANBERIS PASS.

Another interesting feature is the manner in which the high-tension mains are carried out to the take-off construction for the transmission lines. This is clearly shown in Fig. 4. Two transmission lines leave the works, one consisting of a single three-phase circuit going across the valley and over the mountains to the Oakeley quarries at Festiniog. The other line consists of three circuits, which run together as far as Llanberis, where a single circuit branches off to the Dinorwic quarries, while a double circuit continues to Nantlle quarries. The transmission is, of course, all overhead, but the arrangements of circuits and poles vary in different places. The line to Festiniog is carried all the way upon wooden poles. The three wires of the circuits being vertically above each other; they are, however, spiralled, so that they make one complete turn. This is necessary in order to avoid induction to the telephone circuits which would, in all probability, prevent speaking through the same. The distance between the wires is in all cases at least 2 ft., and the height from the ground to the line is 20 ft. across country, and 24 ft. across roads. The poles are normally 30 ft. in length, having a diameter of 10 ins. at the bottom and 9 ins. at the top. Warning notices in English and Welsh are fastened to each pole, and a spiky collar to prevent any one from climbing the pole is fitted about 10 ft. from the ground.

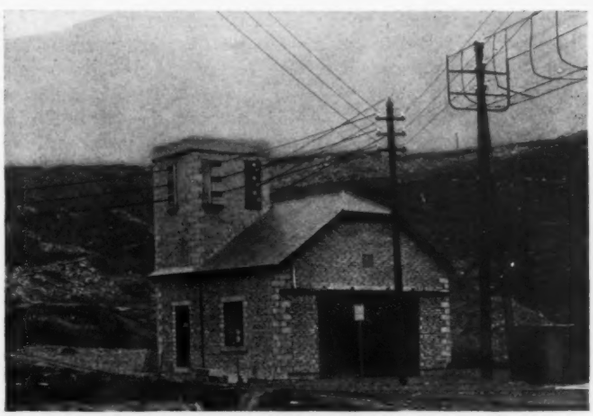


FIG. 7.—COLLIERY SUB-STATION, SHOWING HIGH TENSION AND LOW TENSION FEEDERS.

The Llanberis transmission line leaves the power house on double poles. The three circuits have been arranged vertically and side by side, one three-phase line being outside the right-hand pole, one between the two poles and the other outside the lefthand pole. See Fig. 5. These lines are also spiralled, and they are, moreover, so arranged that wires of the same phase are never contiguous.

In Llanberis Pass, owing to the rough weather which is frequently experienced, it has been thought desirable to utilize steel poles, as illustrated in Fig. 6. In this case the circuits are arranged differently, as will be seen. A fourth type of construction is used on the double transmission line from Llanberis to Nantlle. This is a single pole type with two cross-arms, the upper carrying two wires and the lower four; these circuits are also spiralled.

Power is at present used in three quarries, namely, the Oakeley quarries at Blaenau Festiniog, the Pen-yr-Orsedd quarries at Nantlle, and the Dinorwic quarries near Llanberis. In each case sub-stations have been erected by Messrs. Bruce Peebles & Company, for the North Wales Power & Traction Company, to transform the potential from 10,000 volts to about 500 volts for motors, lamps, etc. Fig. 7 gives an illustration of one of these sub-stations at the Oakeley quarries. This station is typical of all the stations in use. The incoming mains pass into the sub-stations in much the same way as the outgoing mains from the generating station, pass outward; that is, the strain is taken up on substantial shackle insulators, outside the high-tension tower, and from these insulator leads pass up and into the tower through tubular insulators, which are held at their centers by paraffined wood boards. In some cases, the whole construction is, moreover, fitted inside substantial earthenware pipes for each phase, thus affording additional protection from the weather.

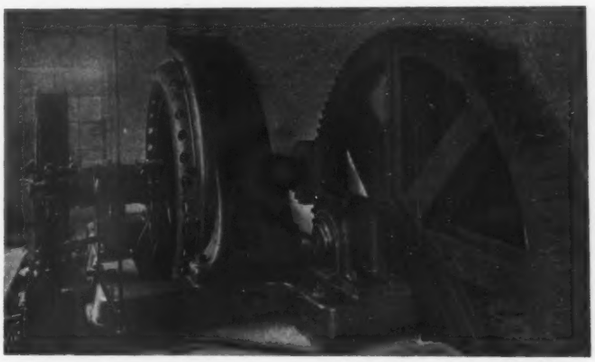


FIG. 8.—200-HP INDUCTION MOTOR DRIVING WINDING ENGINE.

At the Oakeley quarries a very large motor equipment has been installed, including at present about 2000 horse-power in Peebles' motors. Two sub-stations have been erected, each of which contains two 500-kw transformers.

The incoming high-tension feeder which consists, as already stated, of a single three-phase circuit with 9-mm wires, divides into two lines near the quarry, three 6-mm wires being taken to each of the two sub-stations. The sub-stations are also interconnected with each other through the low-tension circuits, so that either may supply the whole load to the quarry when necessary. The tower of the sub-station, into which the high-tension leads pass, accommodates also the lightning arresters and dischargers; after passing the connections to these, the high-tension leads are carried down to the high-tension bus-bars, isolating links being fitted in these bus-bars at either side of the high-tension leads. There are two high-tension switch panels, each fitted with an oil switch with overhead release, and from these switches, connections are carried to the step-down

transformers. Each transformer has a ratio of 9400 volts to 520 volts, there being about 6 per cent drop in voltage between the power station and the quarry end of the transmission line. The low-tension part of the sub-station equipment, which is in an entirely separate compartment from the high-tension side, will consist of eight low-tension feeders, though at present only four are installed in this sub-station, and five in the No. 2 sub-station. The low-tension distributing circuits leave partly overhead and partly underground, the overhead conductors being very heavy stranded conductors braided only where they are within reach, and bare in other places. The underground cables are of the Siemens three-core paper insulated type.

An interesting feature of the low-tension distribution is the type of dividing pole which has been adopted, having ring bus-bars on the top of the pole with isolating switches, which can be operated by the lineman by means of an unhooking rod.

Of the motor applications, perhaps the most interesting are five large main winders, driven by 200-hp induction motors running at 200 r. p. m. These motors are of very massive construction, and are governed by a liquid controller, which allows them to be operated at any required speed from "creeping" to full speed. The particular motor illustrated in Fig. 8 drives a four-drum direct-acting haulage mechanism, working a four-road incline about 250 ft. high, and having a grade of about 1 in 3. The controllers and reversing switches are operated by means of levers and rods from the driver's platform, adjoining the drums, in a separate house from the motor. The motor drives each drum through a separate single-reduction cut gearing and clutches for each drum. An emergency air brake equipment is provided in case of a breakdown of the ordinary hand brake mechanism.

Fig. 9 illustrates an enclosed induction motor which drives a large turbine pump for draining several floors in the underground workings; several motors are used for this purpose.

It will be understood that the Oakeley quarries are largely worked underground, in which respect they differ from the other quarries supplied with electricity by the North Wales Power Company, which are worked, respectively, on the terrace principle at Dinorwic and on the open-pit principle at Pen-yr-Orsedd.

The area covered by the Oakeley quarries being so enormous and most of the operations performed being repetitions of each other, it is unnecessary to take more than a few examples to illustrate the class of work carried out.

The mills are driven for the most part by 15-hp constant-

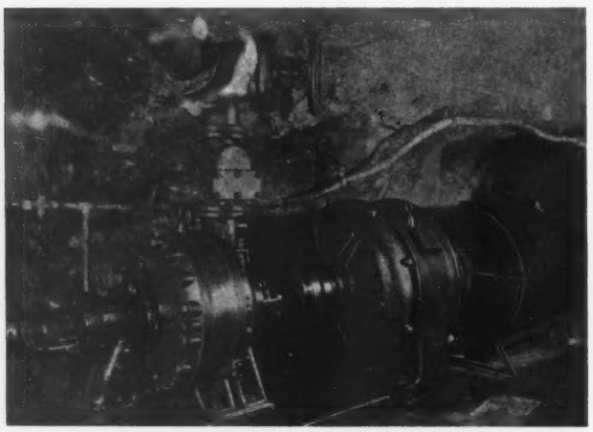


FIG. 9.—INCLOSED INDUCTION MOTOR-DRIVEN TURBINE PUMP.

speed induction motors, fitted with back gearing and rawhide pinions. The equipment of these mills includes trimming machines, slate sawing machines and also, in some cases, slate planing machines; the splitting of slate is, of course, done by hand. The wiring for conveying power to these motors is of bare copper, carried on insulators and secured to the roof. Main armored cables served with tarred cord are run from each sub-station to distributing centers at the bottom of each pit, but the distribution to mills and haulages and winding motors, as aforesaid, is mainly of the overhead type.

At the Pen-yr-Orsedd quarries radically different methods of handling the slate have to be adopted, owing to the fact that the great bulk of the material must be hauled out of enormous open pits, having almost vertical sides. Nearly all this hoisting is done by means of overhead cable ways, electric motors having been installed to take the place of the engines former-

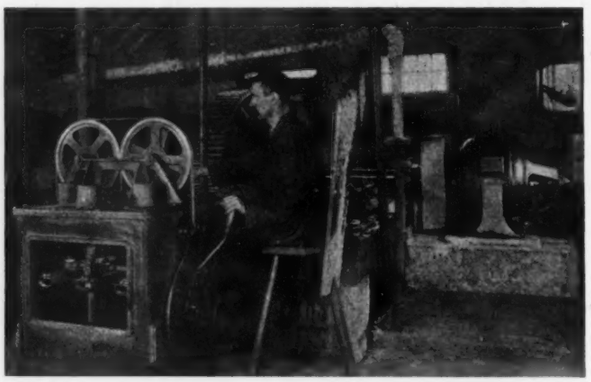


FIG. 10.—MOTOR, DRUM AND CONTROLLER FOR AERIAL ROPEWAY.

ly used to operate these cable ways. Fig. 10 shows the interior of an engine house. The liquid controller which the engine operates, allows the motor to run for any length of time at any speed from "creeping" to full value. It has moreover, the great advantage of accelerating and decelerating gradually and without jerks, thus avoiding the danger of jerking material out of the skips, which is obviously particularly undesirable in this case of overhead rope-ways. Eleven rope ways are operated in this way by means of induction motors, the ratings being respectively two 80-hp, four 50-hp and five 40-hp. There are, in addition, two 40-hp, four 20-hp and sundry smaller machines in use for mills, saw benches, etc.

In conclusion, it may be said that this North Wales installation forms a subject of much interest to British engineers, owing to its unique character.

The contractors for the whole installation were Messrs. Bruce Peebles & Company, who also supplied the generators, motors and most of the electrical equipment. The consulting engineers for the work are Sir Douglas Fox and Partners and Messrs. Harper Bros. The representatives on the spot for Messrs. Harper Bros. were Mr. L. D. Taylor, for Messrs. Bruce Peebles & Co., Mr. W. V. Waite, and for the North Wales Power Company, Mr. A. W. Beuttell, chief engineer. Mr. Georgi was consulting engineer for the Oakeley quarries installation.

## A New End-Cell Switch Indicator.

By A. A. Radtke.

The subject of this article is a new form of end-cell switch indicator, designed to replace the most common form now in use, namely, the "telephone drop type." The latter consists of a number of gravity-restoring telephone drops grouped together and connected individually to small auxiliary contacts arranged at the end-cell switch on the same centers as the main contact blocks. Its operation consists in an auxiliary contact brush attached to and traveling with the main brush, energizing the various drop solenoids successively and thus giving the operator at the board indication of the number of cells in service. This type has operated successfully, having now been installed for about four years. However, it has not been very welcome as a central or substation instrument or device, due to the fact that telephone apparatus does not conform to switchboard apparatus either in form or workmanship, and required the soldering of a large number of conductors on small clips

in a small space. The large number of conductors leading from the point from which indication is to be given is also a disadvantage. In fact, it may be said that its adoption was only due to the urgent need of eliminating the still more primitive mechanical type consisting of rods and gears, which was a continual menace to the safety of a board.

The new type of indicator here described has its connections shown in Fig. 1, and as mounted on the board is seen in Fig. 2. For economy of switchboard space it has been mounted in a seven-inch round pattern instrument case. The mechanism consists of three electromagnets, placed at 120 degrees intervals around a center, with pole pieces projecting inward and enclosing a space in which a rotatable member is mounted. This moving member, a non-magnetic disc carrying a segment of iron, is geared by a train of suitable proportion to the shaft, which carries a pointer.

At the end-cell switch a series of auxiliary contacts is arranged on centers, corresponding to those of the end-cell switch terminal blocks. Paralleling these there is also a small auxiliary contact bar. An insulated brush mounted on the end-cell switch sliding contact energizes successively these instrument contacts, depending on the position of the sliding shoe. This will be made clear by referring to the upper portion of Fig. 1. It will be seen that every fourth contact is connected to a common wire, which in turn leads to one of the terminals of the electromagnets of the indicator. In this manner the three sets of contacts are taken care of by three wires leading to the indicator. The current is supplied, as shown in the diagram, from the operating bus, but it may be taken from any convenient source. One potential is connected to the common negative, or common return, at the end-cell switch, while the other is connected to the remaining terminals of the three magnets.

As the number of cells in service is increased or decreased, due to the travel of the main switch contact, the coils in the instrument are successively energized by the auxiliary contact

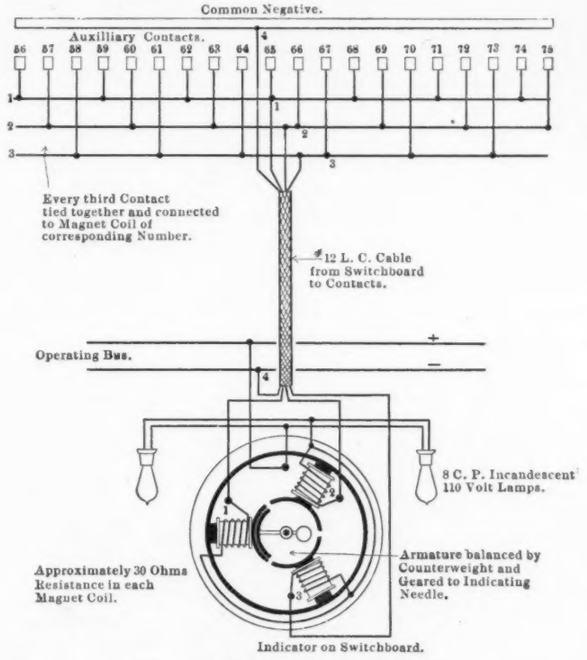

Common Negative.
Auxilliary Contacts.
56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
1
2
3
Every third Contact tied together and connected to Magnet Coil of corresponding Number.
12 L. C. Cable from Switchboard to Contacts.
Operating Bus.
+
−
8 C. P. Incandescent 110 Volt Lamps.
Armature balanced by Counterweight and Geared to Indicating Needle.
Approximately 30 Ohms Resistance in each Magnet Coil.
Indicator on Switchboard.

FIG. 1.—DIAGRAM OF CONNECTIONS.

shoe, closing the circuit between the common return and the individual contacts. This results in a step-by-step movement of the moving member (the segment of iron always taking a position adjacent to the pole face of the energized magnet), and consequently moving the pointer from numeral to numeral on the indicator dial. In order to show whether the main switch stops in a position short-circuiting a cell, additional contacts are placed between those directly opposite the main contact blocks. If the switch stops in a midway position so as to short-circuit a cell, the pointer in the indicator will stop midway between two of the numerals on the dial.

The lamps, mounted on the case of the instrument, indicate that the circuit through the instrument and auxiliary contacts is complete. Two lamps are used to prevent the instrument from falling out of step, in case one of the lamps should burn out or otherwise become impaired.

When several of these indicators are used, it is not necessary to have a separate return wire for each indicator, one wire being sufficient for the return current of any number of indicators. The iron portion of the moving member in the indicator is

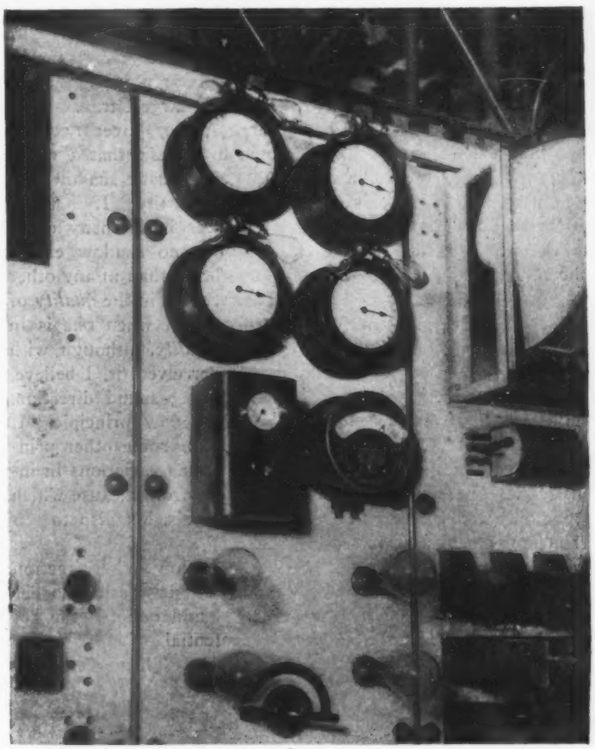


FIG. 2.—FOUR INDICATORS, HARRISON STREET STATION, CHICAGO EDISON COMPANY.

continually under the control of a magnetic field, due to the auxiliary brush contact being wider than one of the gaps between two of the contacts. This allows two of the indicator coils to be energized at the same time during the movement of the main brush contact from block to block, and thus obviate the possibility of inertia of the moving member throwing the mechanism out of step.

The advantages of this form of indicator may be enumerated as follows:

1. Simplicity of construction and operation; 2. Small switchboard space needed; 3. Small installation and maintenance cost; 4. Great reduction in number of conductors from end-cell switch to switchboard.

As an advantage of the saving accomplished by using this system may be cited an installation of four end-cell switch indicators as shown in the photograph at the Harrison Street Station of the Chicago Edison Company, the switchboard being located approximately 400 feet from the battery.

The total cost of this installation, including indicating instruments and multiple conductor cables, was less than 50% of the cost of a similar installation using the multiple drop system of the Electric Storage Battery Company.

This indicator is also adapted for a number of other purposes, such as showing the height of water in a tank or above a dam, the position and motion of an elevator, the signaling from the bridge to the engine-room on board ship, or any similar use.

# Finding Direction by Means of Submarine Sound Signals.

By Lucien I. Blake.

ONE of the methods at present employed by the Submarine Signal Company of Boston for locating the source of a submarine sound signal is to attach two iron tanks, one to the port and the other to the starboard wall, inside a vessel below the waterline and toward the bow. In each of these tanks, which are filled with water, is suspended a microphonic transmitter which is connected through a port and starboard indicator box to a receiving telephone in the pilot house. According to the ship's course, the different intensities of the sounds received locate the direction of the sound source. In every day practice this is successfully done to within a half of a point, and on about 200 vessels at present, among which are the largest trans-Atlantic steamers, representing now (March 1, 1907) over 1,000,000 tons burthen. The generally accepted hypothesis that a vessel in the path of a submarine sound casts an acoustic shadow, has been used to explain this difference in intensity. It is to be observed, however, that marked differences in intensity occur on the *exposed* side of the vessel, where no shadow exists. The sound is louder when the source is abeam than in any other position. Further, there are decided differences in the *quality* of the sound delivered into the two tanks—even when one is in the alleged shadow. The difference in *quality*, although with the majority of observers unconsciously perceived, is, I believe, a larger factor than intensity in determining sound direction, and is not explainable on a geometric shadow principle. It would, therefore, seem necessary to look for some other principle than simple acoustic shadows. So far as variations in intensity are concerned, these can be produced from a cause which is not only amenable to mathematical analysis, but also to experimental demonstration.

From an article by Green, "On the Reflection and Refraction of Sound," *Cambridge Transactions*, 1838, it is possible to derive two equations, one for the reflected and one for the refracted wave, in terms of a velocity potential. Let $\phi$ and $\Phi$ represent the velocity potentials respectively. Then,

$$\phi \text{ (reflected)} = \frac{\frac{\rho_1}{\rho} - \frac{cot\,\Theta_1}{cot\,\Theta}}{\frac{\rho_1}{\rho} + \frac{cot\,\Theta_1}{cot\,\Theta}} \left[ Cos \frac{2\Pi}{\lambda} \left( - x \cos\Theta + y\, Sin\,\Theta + Vt \right) \right]$$

$$\Phi \text{ (refracted)} = \frac{2}{\frac{\rho_1}{\rho} + \frac{cot\,\Theta}{cot\,\Theta}} \left[ Cos \frac{2\Pi}{\lambda} \left( x \cos\Theta_1 + y\, Sin\,\Theta_1 + V_1 t \right) \right]$$

Where (for submarine conditions)

$\rho$ = density of water = 1.

$\rho_1$ = density of ship's side = $\begin{pmatrix} 7.5 & \text{oak} \\ 8 & \text{steel} \end{pmatrix}$

(Smithsonian Tables.)

$\lambda$ = wave length of the sound

$V\ V_1$ = the velocity of sound in the two media.

$\Theta$ = angle of incidence in water

$\Theta_1$ = angle of refraction in $\begin{matrix} (a) \text{ oak} \\ (b) \text{ steel} \end{matrix}$

$t$ = time

From $\Phi$, the amplitude of vibration of the refracted ray is equal to

$$\frac{2}{\frac{\rho_1}{\rho} + \frac{Cot\,\Theta_1}{Cot\,\Theta_1}}$$

As the intensity of a sound is proportional to the square of the amplitude of the vibrating medium, we can use this expression for the relative loudness of sounds transmitted through a ship's walls.

Hence,

$$A.\ \text{Amplitude} = \frac{2}{.8 + \frac{Cot\,\Theta_1}{Cot\,\Theta}} \text{ (oak vessel)}$$

$$B.\ \text{Amplitude} = \frac{2}{7.5 + \frac{Cot\,\Theta_1}{Cot\,\Theta}} \text{ (steel vessel)}$$

By Snell's law of refraction:

$$\frac{Sin\,\Theta}{Sin\,\Theta_1} = \frac{\text{velocity in water}}{\text{velocity in oak (or steel)}}$$

$$\frac{Sin\,\Theta}{Sin\,\Theta_1} = \frac{1}{2.7} \text{ (approx.) water to oak}$$

$$\frac{Sin\,\Theta}{Sin\,\Theta_1} = \frac{1}{3.5} \text{ (approx.) water to steel}$$

From this:

$$\frac{Cot\,\Theta^2}{Cot\,\Theta} = \frac{V \text{ (water)}}{V_1 \begin{matrix} \text{(oak)} \\ \text{(steel)} \end{matrix}} \left[ 1 = \left( \frac{V_1^2}{V^2} - 1 \right) t\, g^2\, \Theta \right]^{1/2}$$

where V and $V_1$ are the velocities of sound in water and oak or steel respectively,

Hence,

$$\frac{Cot\,\Theta_1}{Cot\,\Theta} = \frac{1}{2.7} \left( 1 - 6.29\ t\ g^2\ \Theta \right)^{1/2} \qquad \text{(oak)}$$

And the

$$\text{Amplitude (oak)} = \frac{2}{.8 + \frac{1}{2.7} \left( (1 - 6.29\ t\, g^2\ \Theta) \right)^{1/2}} \qquad \text{(oak)}$$

$$\text{Amplitude (steel)} = \frac{2}{7.5 + \frac{1}{3.5} \left( 1 - 11.25\ t\ g^2\ \Theta \right)^{1/2}} \qquad \text{(steel)}$$

From these last two equations, it is evident that the *intensity* of a submarine sound which enters through the side of a vessel depends simply upon the *angle* $\Theta$, *which is the angle at which the sound strikes the side of the vessel.* This angle is the angle which the *direction* of the sound makes with the *perpendicular* to the ship's wall at the place where the inside receiving tank is attached. However, because of the acoustic conductivity of the material of the vessel's walls, sound which impinges over probably quite a large area in the neighborhood of the tanks is conveyed into the tanks, and thus the angle $\Theta$ should be calculated for the units of area separately and the results added. However, no appreciable error will be involved practically in reckoning $\Theta$ at the surface over the tanks.

From this formula it is easy to see that the smaller the angle $\Theta$ the louder sound; and for $\Theta$ = zero, (when the sound is abeam) the sound is maximum. This fact is well known to all, as above mentioned.

Further, from Snell's law of

$$\frac{Sin\ \Theta}{Sin\ \Theta_1} = \frac{V}{V_1}$$

if $\Theta_1 = 90°$ no sound is refracted—none enters the side of the ship—but all the sound is totally reflected. The angle at which this occurs is called the critical angle, and is evidently for $\Theta_1 = 90°$,

$$Sin\ \Theta = \frac{1}{2.7} \text{ (oak) and } \Theta = 24°$$

$$= \frac{1}{3.5} \text{ (steel) and } \Theta = 19°$$

From the above analysis, it is easy to see that, as far as intensity is the factor, direction finding by submarine sound signals must depend upon the angles at which the sound enters the side of a ship; and as (except when the sound is dead ahead or astern) the angles presented by the two sides to the direction of the sound are *different*, the intensities of the two

sounds are different in the two receiving tanks and thus the transmitters submerged in these tanks indicate different intensities—the louder on the side where the incident angle is the smaller; that is, on the side toward the sound.

In this analysis it is premised that no sound shadow therefore exists on the remote side of the vessel, but that the sound bends around the vessel as an obstacle, and thus enters the portions of the remote side at angles different from the incident angles of the exposed side. It is easy to calculate how far this assumption may be carried out and what influence it has upon direction finding. It is well known that for long waves impinging upon an obstacle, diffraction bands are pronounced and *rays* of sound for long waves cannot be considered to exist. We can, therefore, calculate how much sound of a given pitch bends around a vessel to enter its remote side, and also the distribution of the diffraction bands on that side. This will lead us to an explanation of the different *quality* of the tones, and also of what effect the size of the vessel has and of the effect of the distance of the sound. It gives also a clue as to the best location of the receiving tanks.

A rigid surface, in order to reflect a sound and thereby produce a shadow back of it, must intercept, say, at least ten Huyghen's zones. The radius of the $n^{th}$ zone will be obtained from the formula

$$r^2 = \frac{n\lambda}{\frac{1}{R} + \frac{1}{C}}$$

$r$ = radius of Huyghen's half-period zone.
$R$ = radius of curvature of the wave front at the side of the vessel.
$C$ = distance from wave front to the point where the intensity is desired.
$\lambda$ = wave length.
$n$ = an integer.

It becomes thus a calculation of Huyghen's zones under given conditions of pitch, distance of the sound source and size of the vessel.

I give here for illustration some calculations based upon the pitch of the present standard lightship diaphragm striker of the Submarine Signal Company for a vessel at ½ mile, at 1 mile and at 5 miles distant from the striker in open sea. The pitch of the bell is $D''' = 1215$ vibrations per second, and the wave length is therefore 3.9 ft. at 60° F., which may be called 4 ft. In applying this formula to any particular vessel, one-half the breadth of beam is taken as equal to $C$.

For the Submarine Signal Company's steamer *Sabrina*. $C$ = 10 ft. approximately. The draft of the steamer is 7 ft.

At ½ mile

$$r = (n=1)\left[\frac{4}{\frac{1}{2640} + \frac{1}{10}}\right]^{\frac{1}{2}} = 6.3 \text{ ft.}$$

$$r = (n=2)\left[\frac{2\,4}{\frac{1}{2640} + \frac{1}{10}}\right]^{\frac{1}{2}} = 8.7 \text{ ft.}$$

$$r = (n=3)\left[\frac{3.4}{\frac{1}{2640} + \frac{1}{10}}\right]^{\frac{1}{2}} = 10.5 \text{ ft.}$$

$$r = (n=4)\left[\frac{4.4}{\frac{1}{2640} + \frac{1}{10}}\right]^{\frac{1}{2}} = 12.4 \text{ ft.}$$

At 1 mile

$$r = (n=1)\left[\frac{4}{\frac{1}{5280} + \frac{1}{10}}\right]^{\frac{1}{2}} = 6.3 \text{ ft.}$$

$$r = (n=2)\left[\frac{2.4}{\frac{1}{5280} + \frac{1}{10}}\right]^{\frac{1}{2}} = 8.8 \text{ ft.}$$

At 5 miles

$$r = (n=1)\left[\frac{4}{\frac{1}{10}}\right]^{\frac{1}{2}} = 6.3 \text{ ft.}$$

At ½ mile

$$r = (n=10)\left[\frac{10\,4}{\frac{1}{2640} + \frac{1}{10}}\right]^{\frac{1}{2}} = 19.2 \text{ ft.}$$

At 1 mile

$$r = (n=1)\left[\frac{10.4}{\frac{1}{2640} + \frac{1}{10}}\right]^{\frac{1}{2}} = 19.5 \text{ ft.}$$

At 5 miles

$$r = (n=10)\left[\frac{10.4}{\frac{1}{10}}\right]^{\frac{1}{2}} = 20 \text{ ft.}$$

So that the diffraction bands would thus be about 2′ apart from the bow with the first one covering 6′. It is therefore clear that maxima and minima of intensity would show from the bow aft, growing weaker and weaker for about 20′, when practically a real shadow would begin.

Taking into consideration, however, the draft of the boat, it is self-evident that the same type of bands of maximum and minimum intensity must start from the keel and extend upward parallel to it to about the same distance of 20′ for the conditions stated. Thus, the shadow which the length of the vessel might show would be obliterated by the bending of the sound up around the keel. It is clear, then, that a practical shadow could not be cast by a vessel for a 4′ wave, unless the vessel was over 40′ long and over 20′ draft, and even then the shadow would begin 20′ up from the keel.

The conclusion is interesting. The width of the diffraction bands depends upon the wave length of the sound. For a simple tone the bands would show simply variations in *intensity;* but for a complex sound—a tone and its overtones—there would appear variations in the *quality* at different positions along the bands. The bells at present employed with the submarine diaphragm striker are of 220 lbs. weight and have overtones and consequently variations in quality will be apparent, dependent upon the position of the receiving tanks relative to the zones. Huyghen's zones will move with the motion of the boat, either when changing its course or under influence of the sea, and variations in quality in the transmitters must, therefore, accompany these motions. This has been confirmed by the experiences of all users of the present direction-finding devices.

The question as to the best location of the two receiving tanks on any given vessel becomes thus a question of the relative importance of the two factors, intensity and quality. If intensity is to be alone considered, the tanks should be placed in the Huyghen's zone, where $n$ is the largest possible. If quality is the prime factor, then close to the keel and well forward to the bow is best. But as probably both differences in intensity and quality are most desirable, make $n$ as large as possible for the length of the vessel and put the tanks low toward the keel for quality.

An acoustic survey has been made in the water around the *Sabrina* in Boston Harbor with a standard lightship diaphragm striker at about one-half mile distant. For the exposed side, the standard $D$ tank was used, installed in the usual way within and against the side of the vessel and located about 12 ft. from the bow, and 30 in. below the water line. Variations in *intensity* with $\Theta$ were readily observed—with a maximum at $\Theta$ = zero.

On the *remote* side an overboard portable transmitter was used. Beginning at the stem of the *Sabrina* the variations in both intensity and quality were marked as the diffraction bands were successively passed aft. The transmitter was kept within a few inches of the side and about a foot below the water surface. The vertical bands were thus discovered. As the transmitter was lowered gradually at any point, the horizontal bands were roughly evident. The overlapping of the two sets of bands was confusing, but the variations in quality were unmistakable. As the draft of the *Sabrina* is but 7 ft. *no shadow* was possible and *none was found.* It may be added here, that *no* shadow has been found by actual acoustic survey back and alongside the U. S. battleship *New Jersey,* although she is 440 ft. long and 25 ft. draft; and, in another search, no shadow existed back of two five-masted schooners lashed together, each 200 ft. long and of 16 ft. draft. The sound source was within one-half mile in both these surveys. Thus direction finding by acoustic shadow is not a tenable hypothesis in the system at present employed, while the angle of incidence of the intercepted sound is the determining factor.

# The Resistivity-Temperature Coefficient of Metals.

By Harold Pender.

The primary object of this note is to put into convenient form for easy calculation—particularly when the slide rule is employed—the ordinary formula for the change in the resistivity of copper with the change in temperature. This formula is usually written

$$R = R_0\ (1 + \lambda t)$$

where

$R_0$ = resistivity at 0° C.
$R$ = resistivity at $t$° C.
$\lambda$ = temperature coefficient

The value of $\lambda$ adopted by the American Institute of Electrical Engineers is .0042. In case one wishes to determine the resistivity $R_1$ at any other temperature $t_1$, this formula has to be applied twice, first to determine $R_0$, and then to determine $R_1$, involving at least three distinct slide rule operations. The following formula, which is readily derived from the above, requires but a single setting of the rule:

Put

$$T = 238 + t$$
$$T_1 = 238 + t_1$$

Then

$$\frac{R_1}{T_1} = \frac{R}{T}$$

To avoid the calculation of $T_1$ and $T$, the scale C on an ordinary slide rule can be given a special numbering, putting 0 at 238, 10 at 248, 20 at 258, etc., as shown in the figure, the new numbers to be used for temperatures in degrees Centigrade.

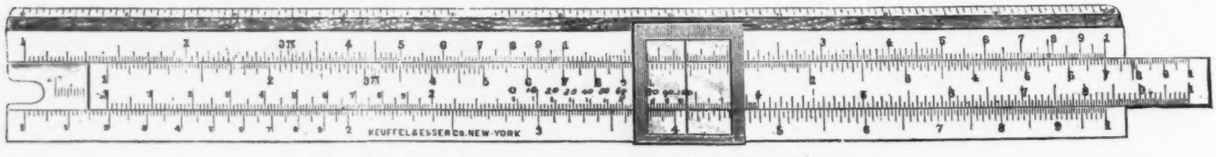



DIAGRAM OF SLIDE RULE MARKED FOR SPECIAL CALCULATIONS.

For example, suppose a copper wire has a resistance of 300 ohms at 13° C., what will be its resistance at 105° C.? Set 13 on the new scale opposite 300 on the lower scale, and read off on the lower scale the desired resistance 410 opposite 105 on the new scale. (Mr. Miles Walker, in the *Electric Journal* for 1905, gives a similar slide rule method, but his method involves either the construction of an entirely new slide, or the use of the tangent scale, giving only approximate results as well as requiring a reversal of the slide.)

The proof of the formula $\frac{R_1}{T_1} = \frac{R}{T}$ follows:

From the ordinary formula,

$$R = R_0\ (1 + \lambda t)$$
$$R_1 = R_0\ (1 + \lambda t_1)$$

therefore

$$\frac{R_1}{R} = \frac{1 + \lambda t_1}{1 + \lambda t} = \frac{\frac{1}{\lambda} + t_1}{\frac{1}{\lambda} + t}$$

or putting

$$T = \frac{1}{\lambda} + t \text{ and } T_1 = \frac{1}{\lambda} + t_1$$

there results

$$\frac{R_1}{R} = \frac{T_1}{T}$$

For copper, $\lambda = .0042$, therefore $1 \div \lambda = 238$.

The formula $\frac{R_1}{R} = \frac{T_1}{T}$ is, of course, applicable to any metal when the proper value of $\lambda$ is used. The following values of $\lambda$ are taken from a table prepared by Parshall and Hobart:*

| | $\lambda$ | $\frac{1}{\lambda}$ |
|---|---|---|
| Aluminum (99 per cent) | .00423 | 236 |
| Bismuth | .00354 | 282 |
| Cadmium | .00419 | 239 |
| Copper | .00388 to .00445 | 258 to 225 |
| Gold | .00365 to .00377 | 274 to 265 |
| Iron | .00625 | 160 |
| Lead | .00387 to .00411 | 258 to 243 |
| Magnesium | .00381 | 262 |
| Nickel | .0050 to .0062 | 200 to 161 |
| Palladium | .00354 | 282 |
| Platinum | .00247 to .0035 | 405 to 286 |
| Silver | .00377 to .0040 | 265 to 250 |
| Thallium | .00398 | 251 |
| Tin | .00365 to .00440 | 274 to 227 |
| Zinc | .00365 to .00406 | 274 to 246 |

It will be noted that the coefficients of iron and nickel are somewhat higher than those for other metals. Possibly the magnetic qualities of these metals may have some connection with this fact. With the exception of these two metals the reciprocals of the coefficients are approximately equal to 273: $\frac{1}{\lambda} + t$ is, therefore, approximately equal to the absolute temperature. In other words, the resistivity of any metal, with the exception of those that are strongly magnetic, is approximately proportional to its absolute temperature.

*Engineering*, Vol. 66, p. 869.

# Street Lighting in Denver.

Denver continues to make progress in her lighting, and her citizens are giving Mayor Speer their unanimous support in making the city worthy of the name, "city of light." The movement which was started by the phrase, "boost for the city of

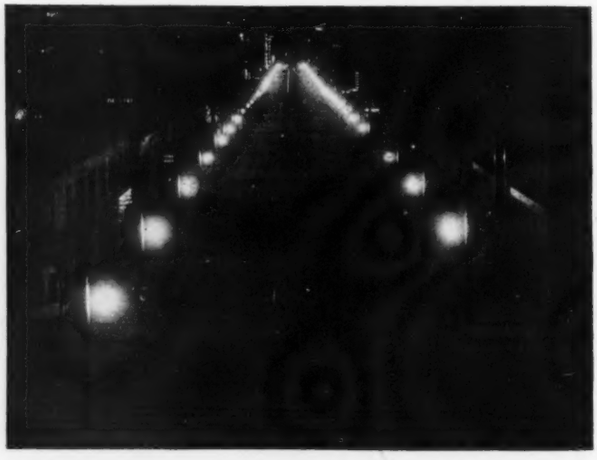


FIG. I.—A DENVER STREET AT NIGHT.

light," a few years ago, resulted quickly in the construction of a "Welcome" arch which has become known all over the country. The arch was built by private subscription, and did much toward inducing merchants to indulge in considerable display lighting. They found it paid, and soon discovered that visitors talked a great deal about the splendid lighting of the city.

Denver has just taken another most ambitious step forward, which does credit to the push and energy of her Mayor, and to the public spirit of her citizens. The construction of a new lighting system for Sixteenth Street has been finished. All of the old arcs have been displaced, and the new lamps present a

FIG. 2.—ELECTRIC LIGHT POST, DENVER.

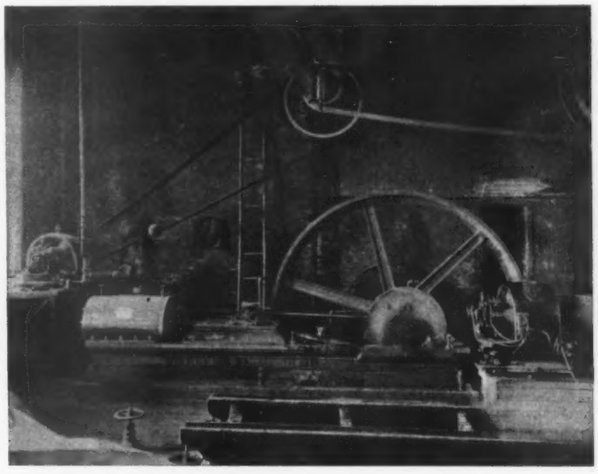
most effective and pleasing spectacle. There are 98 posts of simple but substantial design. On these are also placed the trolley wires. There is no obstruction in the alignment, therefore, as both trolley and telephone poles have been removed.

The new system, which is confined to Sixteenth Street, has cost about $16,000. As the merchants of the other downtown streets are strongly insisting that the new municipal lighting be extended to the principal streets of the city, this will be done as soon as the construction material can be secured.

The new lighting in the business section of Denver is but a portion of the plan of Mayor Speer to make Denver the best and most artistically lighted city in the country.

## Electric Motor Versus Corliss Steam Engine.

A striking illustration of the saving of space possible by the substitution of an electric motor for a Corliss steam engine, not to mention the resultant economy incident to such a change, is shown herewith. The Lackawanna Valley Electric Light & Power Supply Company, of Carbondale, Pa., is responsible for the installation. The illustration shows an old Dickson Corliss engine and the motor which replaced it as a prime mover. The illustration shows the large space occupied by the engine; but not the space occupied by the boiler which fed the engine with steam. This, unfortunately, blew up some time ago, killing the fireman. The motor "on the shelf" in the corner was then substituted for the engine and has been in operation ever since. The motor shown at the other end of the engine was placed there temporarily. Since the motor has been in operation, now some seven years, it has not had a dollar expended on it for repairs outside the replacing of brushes. The bills for electricity have never exceeded $60 per month, and an average taken for three years shows only $34 per month for electricity. This is less than the wages of a single fireman, and when the wages of



ELECTRIC MOTOR AND ENGINE WHICH IT SUPERSEDED.

a licensed engineer, cost of coal, etc., are taken into consideration, the saving since the change will be appreciated. The motor is installed in the machine shop and foundry of Van Bergen & Co., in Carbondale, Pa.

## Utilization of Drainage Canal Power for Chicago Municipal Lighting.

Plans are now under way whereby the city of Chicago will utilize for electric street lighting the power generated at the new water-power plant which is being built on the Chicago sanitary drainage canal near Lockport, Ill. The city of Chicago is to purchase electricity from the trustees of the sanitary district at the rate of $15 per horse-power per year, the power being required for about 11 hours per day; or, to be exact, 4015 hours per year, the length of day varying from 8½ to 14 hours. This is at the rate of .49 cents per kw-hour. From a sub-station at Western Avenue and the drainage canal, 12,000-volt, three-

FIG. 1.—OUTLINE MAP OF CHICAGO SHOWING TRANSMISSION LINES TO MUNICIPAL STATIONS.

phase lines will be connected to four different electric light stations where steam-driven apparatus is at present used. The map (Fig. 1) shows the relative location of these stations in the city of Chicago. The general plan is to install synchronous motors to drive direct-current arc dynamos in stations from which direct-current arc circuits are at present supplied.

The largest and most recent station, at Fullerton Avenue and the north branch of the river, is an alternating-current plant. It will be necessary there to install merely step-down transformers which will reduce the e. m. f. to 6000 volts, which is the bus-bar voltage at that plant.

At the largest direct-current plant, which is at Harrison and

Halsted Streets, the present arrangement of engines driving dynamos is by means of a line shaft shown in Fig. 2. Two 1200-hp synchronous motors will be placed joined to the line shaft. One of these will occupy the position shown by the dotted lines in Fig. 2, and the other will be placed in the other end of the line shaft by shifting the position of some of the dynamos as shown in Fig. 7. These motors will be provided with quill shafts having clutches at each end, so that the line of shafting can be driven by the present steam engines if necessary. At the station at Lincoln and Rice Streets the arc dynamos are driven from a line shafting direct-connected to high-speed engines, running at 210 r. p. m., shown in Fig. 3. At this station one 1200-hp synchronous motor will be placed in the middle of the line-shaft as indicated by the dotted lines.

At the station at Sixty-Fourth Street and Wentworth Avenue, Fig. 4, the present arrangement is somewhat peculiar. Two high-speed engines drive shafting, from which, by means of jack-shafts, two sets of arc dynamos are driven, these dynamos being coupled together as if they were a continuous line of shafting. At this station a synchronous motor will be placed in the line-shaft, which is coupled to the engines as indicated by the dotted lines. At the large alternating-current plant at Fullerton Avenue and the river, three step-down transformers of about 1000-kw capacity each will be installed to feed into the bus-bars of the station.

The 12,000-volt, three-phase transmission lines from the drainage canal sub-station to the various city lighting plants are indicated on the map (Fig. 1). They will be partly underground and partly overhead. The underground cables will be No. 2-0 three-conductor, paper-insulated, furnished by the Standard Underground Cable Company. On the Ashland Avenue overhead work 50-ft. cedar poles will be used. On Sixty-Third Street a combination pole line used jointly with the Chicago City Railway will be put up. On the latter there will be used 40-ft. steel poles with the 12,000-volt transmission line carried well above all other lines. Under the river, the drainage canal and the old Illinois-Michigan canal wires will be taken in a 7-ft. diameter concrete tunnel constructed for the joint use of the city water and electrical departments. This tunnel will contain both the wires and the water-pipe.

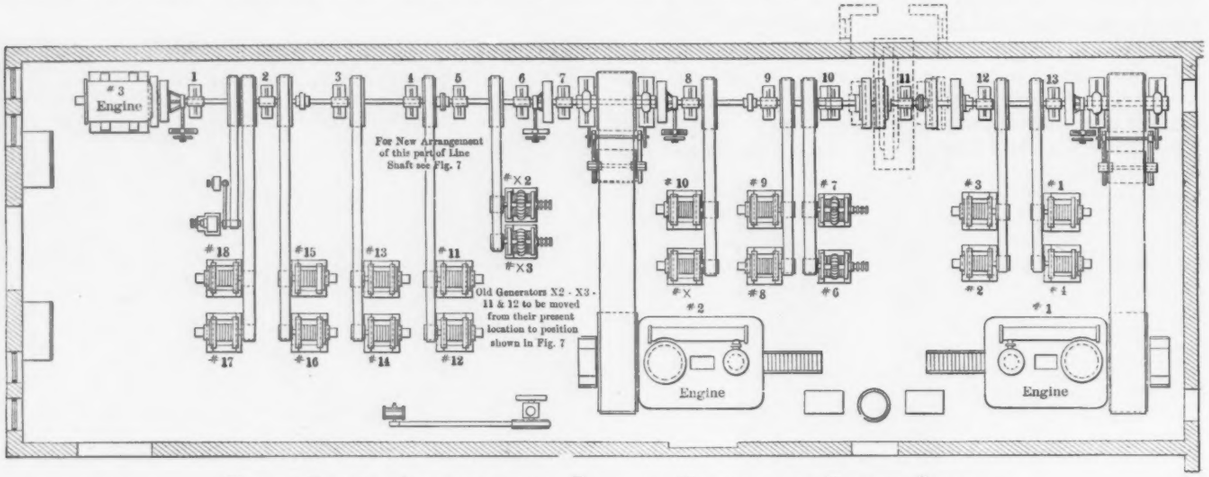

#3 Engine
For New Arrangement of this part of Line Shaft see Fig. 7
Old Generators X2 - X3 - 11 & 12 to be moved from their present location to position shown in Fig. 7
Engine
Engine

Fig. 2.—Present Arrangement of Plant at Harrison and Halsted Streets.

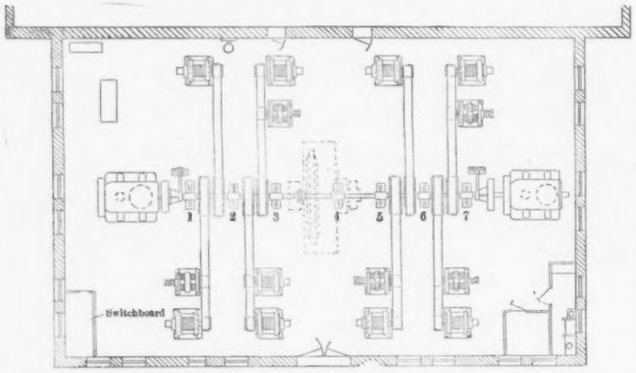



Fig. 3.—Plan of Station at Lincoln and Rice Streets.

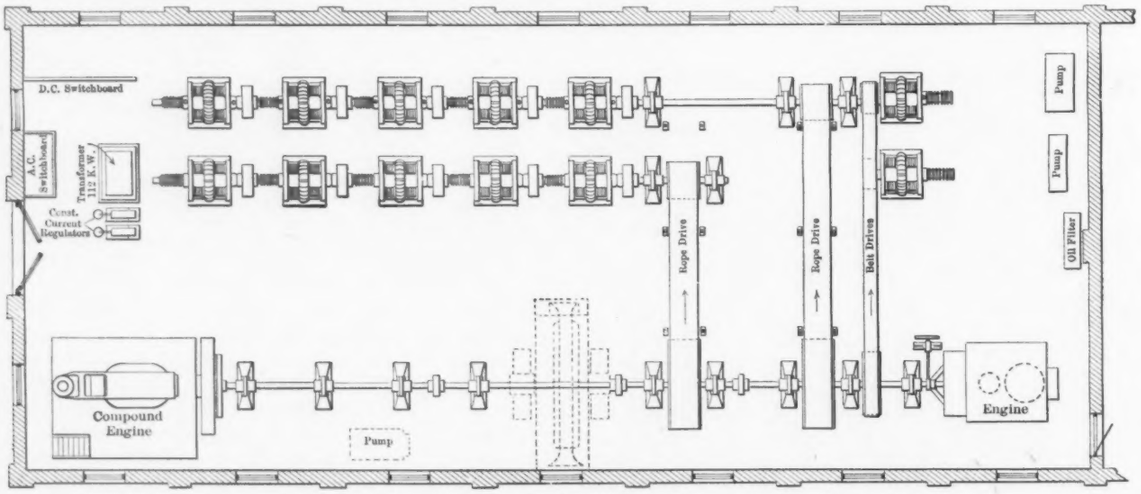



Fig. 4.—Plan of Station at Sixty-Fourth Street and Wentworth Avenue.

SMALL SUB-STATIONS FOR ARC CIRCUITS.

An interesting development in connection with the enlargement of the street-lighting system of Chicago is the installation of numerous small transformer stations, from which street-lighting circuits are operated. The general plan is to run out a 6000-volt constant-potential feeder to a small transformer station to supply a bank of constant-current arc-circuit transformers which serve all of the arc lamps in the vicinity of the sub-station. The object of this plan of distribution is, of course, to save both the number and the length of the circuits which connect to the main power plant. As an entire transformer station is supplied from a single feeder, there is a great saving in cable, as it would otherwise be necessary to run a complete individual arc circuit to each district from the main power station. It is also much easier to locate troubles on short arc circuits than on the abnormally long ones which were common before this scheme of distribution was begun. These transformer stations are located on city property, usually in the rear of fire engine houses on ground which would not otherwise be utilized. Fig. 5 shows the exterior of a transformer station located near an approach to a bridge on city property. The buildings have concrete walls, roof and floors, with protected wired glass windows. Fig. 6 shows the interior of the same station.

FIG. 5.—CONCRETE TRANSFORMER STATION FOR ARC CIRCUITS.

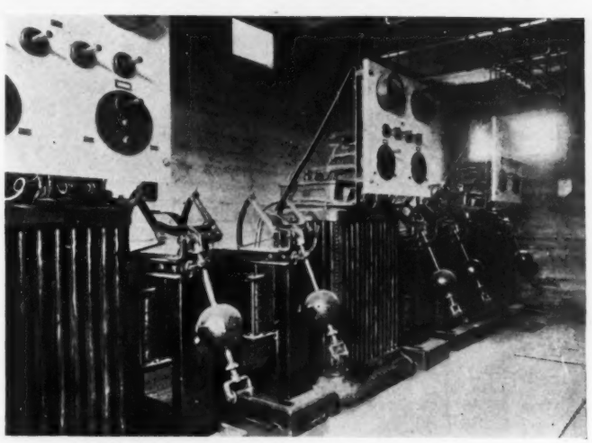


FIG. 6.—INTERIOR OF ARC TRANSFORMER SUB-STATION.

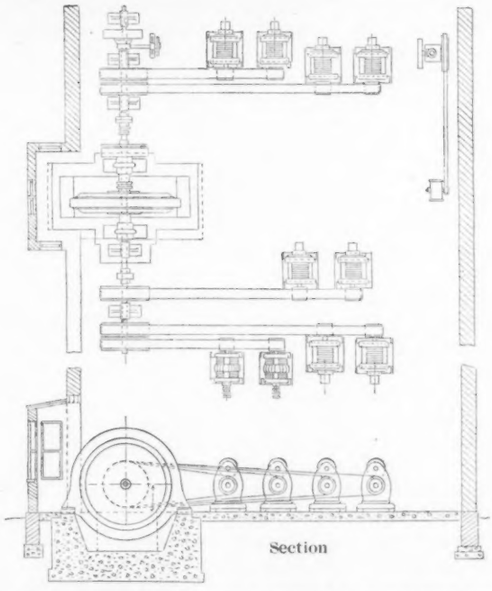



FIG. 7.—EAST END OF STATION AT HARRISON AND HALSTED STREETS.

Ordinarily about 300 arc lamps will be operated from one sub-station. For this purpose the sub-station has three two-circuit transformers and six regulators of the Western Electric type. A patrolman visits each station and starts the circuits in the evening and the station is then closed for the rest of the night. It is the idea to extend gradually the electric lighting system of the city according to this plan. The system is under the charge of Mr. William Carroll, city electrician, assisted by Mr. E. M. Tompkins.

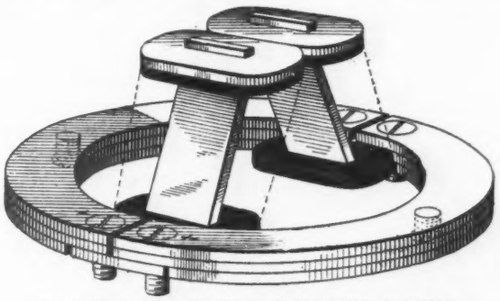
## New Telephone Patents.

NEW RECEIVER.

A solid type receiver forms the subject of a patent granted to L. Steinberger, of New York City. The shell is of pressed metal and the magnetic system is supported by filling the shell about it with insulating material. The metal shell is, of course, roughened on the inside to cause a close bond between it and the poured insulating compound. An insulating tailpiece and cap are provided, the latter being convex toward the ear to better fit it.

NEW APPARATUS.

The cut shows a rather effective way of building up a compact and simple magnetic system for a watch case receiver. Semi-circular compound magnets are assembled to form consequent poles, being held together by the pole pieces. This is the joint invention of A. E. Harrison, of New York, and C. M. Haslett, of Jersey City.



HARRISON AND HASLETT TELEPHONE MAGNET.

An odd transmitter is patented by J. M. Dempsey, of Chicago, in which the diaphragm is connected to the movable electrode through a fulcrumed linkage. The face of the microphone box is a disk of mica, and both electrodes are carried by it. Another novel feature is an agitator comprising a spider which may be oscillated to stir up the granules.

SWITCHBOARD SYSTEMS.

There is no better indication of the tendency of history to repeat itself than the recurrence of old ideas in patents. There is, of course, almost always an introduction of new features in the rejuvenation, but the old elements remain. For example, Messrs. C. G. and E. J. Burke, of New York City, have just patented a system in which the clearing out signal is combined

with the line signal. The idea is stated to be the reduction of the number of banks of signals an operator must watch. The new feature is a flashing lamp for line signal and a steady lamp for supervision. Another similar patent is granted to I. Kitsee, of Philadelphia. This is a "one-wire" multiple system, in which one side of all lines are common at the battery, and only one wire is switched. This allows of a one-wire multiple. A number of previous systems have virtually embraced this idea, but the talking wire has always been supplemented by the necessary signal wires.

AUTOMATIC SYSTEM DEVICES.

A sender for an automatic switchboard has been patented by F. A. Lundquist, of Chicago. The chief feature lies in an arrangement by which the receiver hook descending restores the exchange to zero position. The receiver hook in rising sets the release mechanism, and when the receiver is returned the hook quickly falls, the release mechanism, controlled by a governor, slowly following and making the necessary connections. The apparatus is arranged so that a release is only effected from any station after that station has made a call. Otherwise it would be possible for a second party on a calling line to cut off an existing connection by restoring the line switch.

The same inventor has patented a call registering device for automatic systems. By the proper proportioning of resistances the counting mechanism is not sufficiently energized to register until the called party answers. The removal of his receiver readjusts the currents to cause the calling station meter to count.

POLE DISTRIBUTING RACK.

Fig. 1 shows a pole distributing rack for cable poles, which is a sort of an amplification of the usual two-wire rack. The

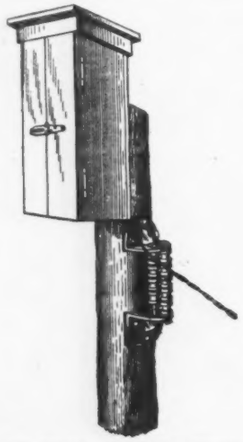


FIG. 1.—ROBINSON POLE DISTRIBUTING RACK.

iron brackets support a spindle which carries a line of insulation. W. Robinson, of Muskegon, Mich., is the inventor, his patent being assigned to the W. G. Nagel Electric Company.

PHANTOM SYSTEM.

Phantom circuits are now in daily use fairly successfully, but in order to make them of easier adjustment, Messrs. J. W. Lattig and C. L. Goodrum, of Philadelphia, have devised a few improvements. It must be understood that a phantom is a line circuit superimposed upon two other circuits and organized with these latter in such a way that three non-interfering simultaneous conversations may exist. The two limbs of each of the real lines, in parallel, compose respectively one limb of the phantom. It is readily understood that if a coil be bridged across the trunk, a neutral point may be found in this at which the connection of another circuit will not affect the existing circuit, as it produces equal and balancing effects up each of its limbs. It will be further understood that the bridged coil is non-inductive to currents entering at the neutral point. The phantom is cut in at four neutrals, one on each line at each end. In the improved systems, there is cut in each real line nearer its ends than the phantom taps, a series coil, inductive to the phantom currents and non-inductive to the line currents. Again, condensers are included in the phantom taps. Another improvement lies in the introduction of an inductance in the middle of the series coils to neutralize any capacity effect they may introduce.

RINGING DEVICES.

In Fig. 2 is shown a ringer of novel construction wherein all adjustment is done by means of a single screw in the yoke. The

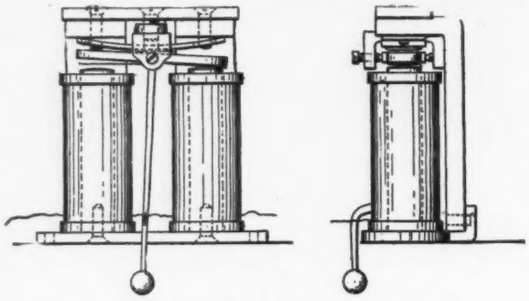


FIG. 2.—WEMAN SIGNAL.

screw raises or lowers the armature, the spring piece maintaining the equilibrium. This ringer is the invention of Klas Weman, of Buffalo, N. Y.

PARTY LINE SYSTEM.

C. A. Anderson, of Salina, Kans., has patented a step-by-step party line system. In this system the central assists on all calls and the selection is done by means of a trailer and selected contact.

## Recent Electrochemical Developments.

PRODUCTION OF ALLOYS IN THE ELECTRIC FURNACE.

We have repeatedly referred in these columns to the work of Mr. F. J. Tone, of the Carborundum Company, of Niagara Falls, with respect to the production of metallic silicon and silicon-alloys in the electric furnace. The alloy problem seems at first sight very simple. For instance, to make copper-silicon, if a charge of copper, silica and carbon is subjected to the high temperature of an electric arc the silica will be reduced by the carbon and the silicon will alloy with the copper. The same principle may be employed for the manufacture of other alloys, but in many cases a large loss of material is experienced by evaporation due to too high a temperature. Mr. Tone, therefore, does not use an arc furnace but a resistance furnace, the charge forming the resistor. Further, he adds to the above mixture a flux and produces a slag which protects the alloy collecting below. For instance, to make manganese silicide, he mixes silica, manganese dioxide, carbon and lime, and heats this mixture by an electric current introduced through two electrodes dipping into the surface of the bath. The manganese silicide settles in the bottom of the receptacle, with the slag overlying the alloy.

A similar problem is attacked in a recent patent of Mr. T. L. Willson, of calcium-carbide fame. For the treatment of a ferro sulphide ore he treats a mixture of the crushed ore with limestone, sand and coke in his familiar arc furnace and produces a ferro-nickel silicide which is chiefly useful in the production of nickel steel. The same method is also applicable to the treatment of silicates of iron, nickel and manganese such as those known as New Caledonian ores.

While the production of special alloys has reacted remarkably upon various metallurgical industries, the fact has been probably most evident with iron and steel. This is a matter which should be studied most carefully by the manufacturers of electrical machinery. For them it is in many cases of the highest importance to reduce the eddy-current and hysteresis losses to a minimum. It is known that some of the specially-low-carbon steels, made in electric furnaces in France, have been sold to electric manufacturers for transformers. In general, however,

it is not the content of carbon alone which is of decisive importance, since the addition of very small quantities of other elements offers the highest possibilities.

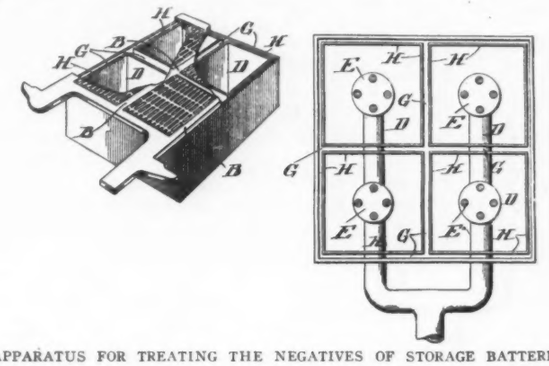
Various special steels recently made for electrical purposes have been noticed in this journal, especially in the Digest. Curves were recently reproduced in the Digest on the electric behavior of two such special steels made in England. They may have some connection with a patent recently granted to Mr. R. A. Hadfield, the famous steel master of Sheffield. It refers to an "alloy having magnetic and electric properties, especially adapting it for use in ballast coils, transformer plates and like electrical apparatus, for which it is of great importance to reduce the total magnetic and electric losses to the lowest possible degree." His steel is low in carbon, which is less than 0.2 per cent, and it contains silicon, manganese and aluminum. Two special compositions are stated. The first contains 0.08 carbon, 3.98 silicon, 0.08 manganese and 0.95 aluminum. The other contains 0.09 carbon, 3.57 silicon, 0.67 manganese and 0.1 aluminum. It is to be regretted that the special properties of these two compositions are not stated.

BATTERIES.

Among several storage battery patents recently granted to Mr. Joseph Bijur, of New York City, there is one of particular interest. Mr. Bijur is the president of the General Storage Battery Company which makes the Bijur "high duty" storage battery. The special patent we refer to relates to the treatment of the negative plates, that is, the spongy-lead plates. It is well known that in the past much trouble has been experienced by all battery makers on account of the negatives losing their capacity. Batteries had to be put out of service although the positives may still have been in good condition. There may be various causes for this trouble. The active mass of spongy lead may lose its coherence in itself and particles may drop off, or it may lose its adherence to the solid support. This may cause the active mass to fall off or a sulphate layer may be formed between the solid support and the active mass which acts as an insulator. All these effects diminish the capacity. In the case of the negatives, however, one other peculiarity has been observed, namely, that the pores always have a tendency to contract and the active mass loses its spongy character and becomes solid lead. This means, of course, a reduction of the active surface and a corresponding diminution of the capacity.

The method by which Mr. Bijur prevents this reaction is to impregnate the active spongy lead with an inert material like carbon. He states that in this way the passageways for the diffusion of the electrolyte into the pores of the plate are maintained intact during service and that the plates treated by his method are strong and hardy. A special feature is that the carbon is introduced after the plate is finished. The process is equally applicable to Planté plates and pasted plates. In the case of a Planté plate, the dried plate is soaked for about ten minutes in a solution of sugar of from 2 to 30 per cent, by means of which the pores of the plate become filled with the solution. The plate is then removed from the solution and dried.

The plate is now a mixture of active mass with sugar and the next step of the process is to carbonize the sugar by means of heat. Treatment at a temperature of from 240 to 300 degrees C. for five or ten minutes is sufficient. If the entire plate is of pure lead it is raised to this temperature in a suitable oven or furnace. If the plate, however, has antimonious alloy parts as, for instance, an alloy frame, care must be taken during the heating operation to insure that the frame is heated less than the active mass, since otherwise the frame might be partially fused on account of the lower melting point of the alloy. A simple apparatus for this purpose is shown in the adjoining diagrams. As shown in the right-hand diagram, it consists of a sheet-steel framework of several compartments each of which contains a gas burner *E*. The steel framework is double in form and is provided with air spaces *G* between the walls *H* of the framework; the compartments *D* are of the same size as the grills on the plate so that when the plate is laid on top of the framework, as shown in the left-hand diagram, the grills are above the burners, and the framework *B* of the plate lies above the cooling air spaces *G*. After the plate has been baked or heated it may be rinsed to remove any of the particles of sugar which were not converted into carbon in the heating process, and the plate is ready for use. The treatment of pasted plates is quite analogous, and in this case the process may be applied even after the plates have been in use and have partially lost their capacity, thereby again raising the capacity of the



APPARATUS FOR TREATING THE NEGATIVES OF STORAGE BATTERIES.

plate. The Planté plate ever after having been treated by this process has a light brownish-gray color, instead of the usual lead-gray color of the ordinary Planté negative plate. The plate has a very porous and spongy appearance.

This method is stated to have been in use for over a year at the works of the General Storage Battery Company with full success, and if future experience confirms these results, this extremely simple method will be the happy solution of one of the most puzzling difficulties of storage battery manufacture.

# LETTERS TO THE EDITORS.

## Sensitiveness of Voltmeters.

*To the Editors of Electrical World:*

SIRS: An article in your issue of March 16, entitled "Voltmeters for U. S. Signal Corps" (page 561) contains several statements which may mislead readers not thoroughly informed as to the high degree of sensitiveness that has been attained in the design and manufacture of modern voltmeters.

The article states that the instrument described therein has particular interest in view of the high resistance called for, which "meant the construction of a commercial instrument, with pivoted moving coil, having a resistance of 1667 ohms per volt, which meant that the makers had but 1/1667 of an ampere at their disposal for full scale deflection." It is furthermore stated that the instrument described is believed to be "the most sensitive instrument put into commercial use in the shape of a calibrated instrument with shunted movable coil."

In view of the publicity given to these statements in the article, we consider that it will be of interest to your readers to learn that for at least the past 15 years this company has been furnishing commercial instruments of the portable type guaranteed to an accuracy of 1/5 of 1 per cent, giving full scale deflection with 600 volts through a self-contained resistance of 1 megohm (1,000,000 ohms), so that there has been no novelty introduced to the art by producing an instrument with a resistance of 1667 ohms per volt.

It is perhaps still more interesting to note that we have during the past five or six years furnished numerous customers with several hundred of our standard switchboard instruments, designed to operate on a potential of 40 volts through a self-contained resistance of 100,000 ohms, which sensitiveness represents a resistance of 2500 ohms per volt, and a current required for full scale deflection amounting to .0004 amperes, two-thirds of the amount specified in the aforesaid article.

The particular examples herein mentioned do not, however

indicate the extreme limitation of the sensitiveness of instruments of this type when properly manufactured; for should the requirements of any branch of the electrical industry demand it, there is no reason why voltmeters comprising all the essential characteristics should not be furnished with a resistance of 5000 or more ohms per volt, or a current consumption of .0002 amperes for full scale deflection.

Newark, N. J. Caxton Brown,
*Secretary Weston Electrical Instrument Company.*

## Calculation of Dynamo Sparking Characteristics.

*To the Editors of Electrical World:*

Sirs: In your issue of March 9 there appears a communication from Mr. Cecil P. Poole, in regard to a recently published article of mine on the calculation of dynamo sparking characteristics. In this communication Mr. Poole states that the formula which I have proposed "does not take into consideration the armature reaction upon the magnetic field." Now my formula does do just this thing; that part reading $\frac{4.5 f l N^2 r P_p}{10^8 S m P}$ being the voltage which the armature reaction causes to be generated under the brush, when one ampere is passing through the armature. This is approximately correct when the short-circuited coils are in a region midway between the pole pieces. The formula, of course, does not take into consideration the amount of field distortion at any other point around the armature circumference. However, it is only the amount of distortion at that point on the armature surface occupied by the coil during commutation which can affect sparking. We are, therefore, justified in omitting everything else from the formula.

It is for exactly the same reason that my statement, "if the dynamo is designed to carry its greatest load without moving the brushes from the geometrical neutral point, the reluctance of the air-gap may be made as small as is rendered desirable by other considerations, without regard to its effect upon the sparking point," is correct. The effect of the air-gap length on commutation is indirect. If reliance is placed upon giving the brushes sufficient lead to bring the short-circuited coils into a commutating field of the proper polarity, then it is evident that in order to find this field under the pole tip the field ampere-turns required to overcome the reluctance of the air-gap must be considerably greater than the armature ampere-turns at full load. A certain length of air-gap is, therefore, required in this case, in order that enough ampere-turns may be placed in the field coils to overcome the effect of the armature ampere-turns. With the brushes set on the geometrical neutral point, the case is very different. The effect of the main fields must obviously be zero at a point on the armature surface midway betwen the poler pieces, and therefore the amount of field distortion at this point will be independent of the number of ampere-turns in the field coils and consequently independent of the length of the air-gap. It will depend only on the number of armature ampere-turns and on the reluctance of the path followed by the lines of force. Of course, the moment the brushes are moved from this geometrical neutral point, the number of field ampere-turns required for the air-gap, and consequently the length of the air-gap, must be taken into consideration. This is done in my formula by adding the symbol $v_2$ to the numerator.

The reason for leaving the formula in the form in which it was given, instead of simplifying as Mr. Poole suggests, is that by doing so the actual reactive voltage and the actual voltage which field distortion causes to be generated under the brush, with one ampere passing through the armature, are thereby found. These are concrete figures which mean something to the designer. For the most economical design, a certain ratio between these values should be adhered to; the actual value of this ratio depending on the relative cost of reducing these values. Thus in the example which I have given, the reactive voltage per ampere is .123 volts and the distortion voltage per ampere is .157 volts. The ratio $\frac{.123}{.157}$ is an economical one for this machine.

Braintree, Mass. Carlton L. Kennedy.

# DIGEST OF CURRENT ELECTRICAL LITERATURE

### Dynamos, Motors and Transformers.

*Influence of a Condenser in the Secondary Circuit of a Transformer.*—Brenot.—A short article illustrated by diagrams on the phase difference between e. m. f. and current of an alternator supplying the primary circuit of a transformer the secondary of which contains a condenser. The author gives a graphical method based upon certain simplifying assumptions.—*L'Eclairage Elec.*, March 23.

### Lamps and Lighting.

*Flame Arc Lamp.*—Hatfield.—An illustrated article in which the author first makes some general remarks on difficulties and special features of flame arc lamps in general. He then describes a lamp of Lewis. In it one or more pairs of carbons are set in the inclined position with their upper ends in holders guided on rods, inclined at the same angle as the carbons, the carbon holder of each pair being linked together to a central guide piece, so that the two carbons fall together equally as they move away. One carbon is guided through a hole in a slider plate, the other through a hole in a globe cap—this carbon being held by a washer clutch. The lamp is controlled directly by a powerful shunt and series coil, and the lamp starts with its carbons together, the carbon holders being caught under hooks for trimming and then released. The action of the lamp is seen in Fig. 1. The series coil *A* starts the arc by moving the sliding plate *B* through a link *C*, and lever *D* pivoted at *E;* and at the same time the other carbon is held by means of a clutch *F*, which comes into action when the tripping plate *G*, which is also fixed direct to the lever *D*, is lowered. The regulation then takes place in the ordinary manner, the feeding being accomplished very gently and regularly by the tripping plate momentarily releasing the clutch *D*. It is necessary now to provide some arrangement by which the weight of the carbons and

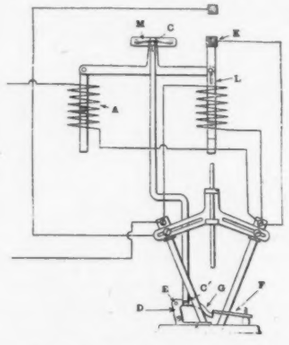



FIG. 1.—FLAME ARC LAMP.

linking mechanism shall not force the plate outwards when they are released after trimming, and so prevent the arc striking at all. This is accomplished by arranging that pivots *C C* at the ends of the link are in straight line with the center of the lever of the lamp, so that when the lamp is in its starting position no

amount of pressure on the plate will cause any motion of the lever and the cores. This has the further advantage that the restoring force of the lever on switching off is enormously multiplied, as the link comes into its final position for the dead point, and thus very great pressure, indeed, can be exerted to force the carbon ends together. This pressure is so great that the link should not act rigidly on the sliding plate, but through a stiff spring *M*, otherwise the carbons are liable to be broken. This mechanism enables the pairs of carbons to be multiplied by simply adding clutches and guides, as the arc will strike on any particular pair of carbons, and when these are burnt out will then proceed to strike on others, in the manner well known in ordinary open type double carbon lamps. In order that the arc may be extinguished when the carbons have burned completely away a short-circuiting switch *K* is provided which comes into action when the voltage across the carbons slightly exceeds the normal amount. The effect of short-circuit in the arc is to cause it to extinguish. The arc then strikes another pair of carbons, if another pair is available. The shunt core is connected to the lever through a slotted link *L*.—Lond. *Elec.*, March 15.

*Carbone Flame-Arc Lamp.*—An illustrated description of the Ediswan-Carbone flame arc lamp which is distinguished from other flame arcs by the following features: The length of the arc is greater than with most other flame arc lamps; the particular arrangement of the blow-out coils, which gives the characteristic shape to the flame and ensures its steadiness; and the fact that pure carbons are used, producing a white flame instead of the more usual yellow light given out when certain chemically impregnated carbons are employed. The use of pure non-impregnated carbons has also the advantages that the lamp may be used for indoor lighting and that there is no danger of corrosion of the mechanism of the lamp. The peculiarity of the method of controlling the position of the arc lies in the employment of a closed iron magnetic circuit, the only field influencing the arc being that due to magnetic leakage from this closed circuit. Into the wing forming this closed magnetic circuit are fixed cores carrying the solenoids used for excitation, and in consequence the chief magnetic leakage will obviously be from the ends of these. This ring also serves to hold the economizer and a very simple method is adopted of still further increasing the magnetic reluctance, and consequently the leakage at points is approximately at right angles to the cores. The result is a magnetic leakage field of moderate strength, which serves to maintain the arc at the tips of the carbons, the flame covering the mouth of the economizer in a shape much the same as that of a partially blown soap-bubble at the bowl of a pipe. The lamp is said to be equally suitable for direct or alternating current.—Lond. *Elec. Eng'ing*, March 21.

*Enclosed Arc Lamp.*—An illustrated description of the Davy enclosed arc lamp, shown in Fig. 2, in which the following features are said to be novel. The first point is the absence of any shunt coil, the regulation of the feed being controlled solely by the series solenoid. The disadvantages of the shunt coil are its liability to break down, and the variation in the length of arc produced by its temperature-resistance changes. In the older types of open lamps, with their short arcs of critical length and voltage, the duty of the shunt coil in maintaining an exact and frequent feed rendered it practically impossible to dispense with its services. In the enclosed type of lamp, however, due both to the longer arc and its less critical voltage, the regularity of the carbon feed becomes of much less relative importance. It is very probable that in "shuntless" lamps the top carbon is fed about a quarter of an inch at a time, but as this feed only takes place about once an hour, the accompanying flicker causes no great inconvenience. The second unusual feature is the use of a spiral spring to oppose the pull of the solenoid, in place of the customary gravity control. This arrangement possesses the advantage that the increasing pull of the solenoid upon its core as the latter enters therein is balanced by the increasing pull of the stretched spring. The net result is that the working stroke of the core can be much increased, with, at the same time, a more equable pull and increased sensitiveness to current variations. The clutch is of the usual rocking washer type, acting directly upon the carbon. The air dashpot is fixed near the top of the lamp, and is of quite small size. It is claimed that a perfect air dashpot is purely a matter of correct

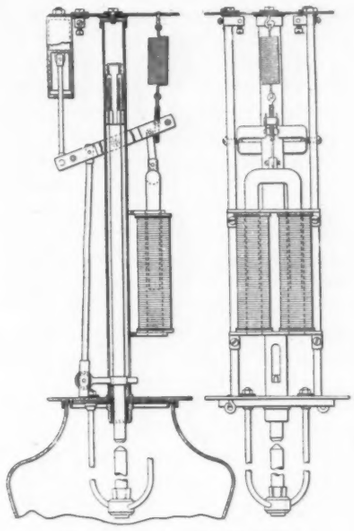


FIG. 2.—ENCLOSED ARC LAMP.

manufacture, and that the inverted type of dashpot which is used in this lamp never caused the least trouble.—Lond. *Elec. Eng'ing*, March 21.

*Magnetite Arc.*—Cady.—A communication referring to a statement of Steinmetz that the potential difference in the magnetite arc at 1 ampere is higher than the computed value, the discrepancy varying from 7 to 15 volts for different lengths of arc. The present writer thinks that this increase in p. d. for small currents is due to the transition having been made from the hissing stage to the quiet stage of the magnetite arc. The "iron" arc in air really takes place between globules of magnetic oxide of iron. The change from the hissing to the quiet stage occurs usually with a current somewhere between one and two amperes. At the hissing point the p. d. abruptly rises 10 to 15 volts, while the current decreases by a small fraction of an ampere. The positive electrode is the seat of the effect. In experiments with an arc between a magnetite rod and a block of copper the hissing point was found just as with the iron arc as long as the magnetite formed the positive pole. But when the magnetite was connected to the negative pole, no discontinuity in voltage or current could be detected as long as the copper was fresh and clean. But as soon as a trace of iron had become deposited on the copper the hissing began.—Lond. *Elec.*, March 8.

*Low-Voltage Osram Lamps.*—A note on osram lamps for voltages of from 1 up to 25, for use on automobiles, motor boats, etc. The storage battery will yield sufficient current for from three to five times the amount of light which is obtained with carbon filaments; or in order to get the same cp-hours, the size of the battery may be correspondingly decreased. This low-voltage type of osram lamps is now being placed on the market in Europe.—*Zeit. f. Beleucht.*, March 20.

*Series Lighting.*—Sayers.—Some historical notes on continuous-current series systems in use in the early eighties in connection with both incandescent and arc lighting.—Lond. *Elec. Eng'ing*, March 21.

## Power.

*Electricity Supply to the Industrial District of Rhineland and Westphalia.*—An article on the formation of the United Electricity Works Company in Hagen, in Westphalia. This means that the intention of H. Stinnes and A. Thyssen to monopolize the electricity supply in the whole important district has been defeated. They wanted to do this in connection with the electricity station in Essen, which they control. The fight which has been

going on for almost two years, and which has been quite bitter, was carried on in the press under the motto "municipal ownership versus private corporation." However, it is pointed out in the article that the result was really brought about by certain Berlin financiers who considered a monopoly to be contrary to their interests. Stinnes and Thyssen, through their intimate connection with a great many metallurgical plants, could have produced cheap power from blast-furnace gases. The opposition to their monopoly comprises really three different groups of men, who have now united. They intend to erect one central station and to sell electricity to each of the three different groups, each of which will then supply its own customers. However, this central station exists so far only on paper, while on the other hand, the Stinnes-Thyssen interests have already erected a plant for the district of Hoerde. "This result characterizes the difference between the two undertakings. While the municipal ownership leaders are still deliberating how, when and where to erect the new station, the private company has already finished its plant."—*Elek. Zeit.*, March 14.

*Cost of Electrical Energy from Blast-Furnace Gases.*—In an article on the supply of energy to the Rhenish-Westphalian industry district it is incidentally mentioned that the two Lorraine-Luxemburg blast-furnace iron works of Rombach and Maizieres furnish electrical energy to the electric station of the city of Metz at the rate of 1.75 cents per kw-hour. The electricity is, of course, produced by generators coupled to gas engines which are fed with blast-furnace gases.—*Elek. Zeit.*, March 14.

*High-Tension Direct-Current Series System.*—Highfield.—The conclusion of his illustrated paper read before the (British) Institution of Electrical Engineers on the well-known Thury system. In the present installment, the author describes the equipment of the power station, the line and the sub-station, and gives tables comparing the cost of this system with three-phase transmission. The author insists that this system has reached a point far beyond the experimental stage, although the size of the machines hitherto built for this system is comparatively small.—Lond. *Elec.*, March 15. The paper, together with a full report of the discussion, also in Lond. *Elec. Eng'ing*, March 14, 21.

### Traction.

*Alternating Current Traction.*—In the course of a discussion on alternating current traction before the International Society of Electricians, in Paris, Gratzmuller mentioned a new polyphase traction system which belongs to the general type of the systems of Aubert and Ferrand. Everybody knows that if the difficulties of starting squirrel-cage induction motors and of regulating their speed could be overcome they would be ideal for traction purposes, in view of their extremely simple construction. The author purposes to regulate the speed by supplying the motor with current at a frequency which is low during starting and is gradually increased. The constant-frequency current from the transmission line is supplied to an induction-motor stator, thus producing a revolving field. This stator is provided with an armature with commutator on which three brushes are revolving. If these brushes revolve with a speed equal to that of the revolving magnetic field direct current is taken off. If the brushes are stationary, alternating current is obtained of the same frequency as the supply current. If the brushes are revolved with an intermediate speed, the frequency of the currents produced depends on the slip. The speed regulation will, therefore, be obtained by regulating the speed of the brushes.—*L'Ind. Elec.*, Feb. 25.

*Blast-Furnace Gases for Railway Operation.*—Junge.—An article of a somewhat general nature recommending the use of the waste gases from blast-furnaces or coke ovens as a source of power for the operation of railways. The gases are, of course, to be utilized in gas engines coupled to electric generators so that the method supposes the use of electric traction on main railways. The author also analyzes the possibilities of opening up undeveloped bodies of rich ore available in remote districts by improving and cheapening in this way transportation facilities, thus creating new independent iron-producing centers for the supply of those markets from which the development of industries has been precluded owing to the lack of suitable fuel.—*Cassier's Magazine*, April.

### Installations, Systems and Appliances.

*Austria-Hungary.*—Honigmann.—The conclusion of his statistical article on the commercial situation of the electrical industries in Austria-Hungary. There does not yet exist any statistics of the present electric plants in Austria. For Hungary it is stated that there are 109 plants supplying 141 towns with energy. Of these, 53 are operated with direct current and 56 with alternating current. Most of the direct current works use the three-wire system either with 2 x 110 volts or 2 x 220 volts. Ten direct-current stations have a supply voltage of 550, since they also furnish power for traction. Among the alternating-current stations there are 26 with single-phase, two with two-phase and 34 with three-phase currents. The secondary voltage is mostly from 100 to 110 volts. The total investment in electric plants, including traction stations, amounts to almost $40,000,000, of which $25,000,000 is invested in pure traction plants. The capacity of the generators is 42,277 kw. There are connected to the mains 31,600 incandescent lamps for public lighting, 1215 arc lamps for public lighting, 2882 electric motors aggregating 8800 horse-power (excluding traction motors), and 43,520 meters. In Austria, transmission systems from water-power plants are gaining in favor. On the other hand, most plants in Hungary use steam. Some statistical data are given on new direct-current and alternating-current stations erected in 1905. It appears that the number of new direct-current stations is about the same as that of the new alternating-current stations. Electric power is now being largely introduced into mining, the Ilgner winding system finding special favor. Rolling mills are also being electrically equipped.—*Elek. Zeit.*, March 14.

*London.*—Brown.—An article, illustrated by maps, on the different electric power-supply stations and districts of London.—*Cassier's Mag.*, April.

*Electricity Supply Management.*—An anonymous article by a "supply manager." There should be only one head, the general manager, of an electricity supply station. He need not be a highly skilled engineer, but, on the other hand, a purely commercial man is worse. There are five departments. The two principal engineering departments are the station department and the mains department, being in charge of the residing engineer and the mains engineer. Both must be engineers. The main difference between the engineering ability of these two men and that of the general manager is that the latter is compelled to look at pretty engineering schemes through financial spectacles. The third is the meter department, partly engineering and partly commercial, and should be in charge of an assistant who reports directly to the general manager. The fourth is the sales department, which is the most important commercial department. The fifth and last is the publicity department. All five departments are under the general manager and weekly conferences are recommended between the general manager and the heads of the departments.—Lond. *Elec.*, March 15.

*Bookkeeping for Central Stations.*—Denholm and Maccall.—Two papers read before the Glasgow section of the (British) Institution of Electrical Engineers on the methods of bookkeeping adopted in the Glasgow electricity works.—Lond. *Elec. Eng'ing*, March 21.

*Regulations.*—Safety regulations for electric systems proposed by the Electrical Society of Vienna. The set of rules will be voted on at the next annual meeting.—*Elek. und Masch.*, Feb. 3, 10 and 17.

### Wire, Wiring and Conduits.

*Bare Aluminum Coils.*—Hopfelt.—A paper read before the Dresden Electrical Society. At ordinary temperature aluminum is covered with such a dense layer of its oxide that the metal is protected against the influence of weather and of most chemicals. Such an oxide layer has an electrical insulating strength sufficient to resist about 0.5 volts. It is, therefore, possible to wind magnet coils, etc., with bare aluminum wire and to put

adjoining windings of a single layer in direct contact with one another. The current will not pass over from one turn to the next turn through the contact surface as long as the voltage between the two turns is less than 0.5. For direct-current aluminum coils, even if one turn has more than 1.5 meters length, the voltage between two turns is generally not more than 0.06 volts, so that there is a safety factor of 10. Of course, some insulating material must be placed between every two successive layers. If a finished coil is placed in water and current is then passed through, the insulating oxide layer is very strongly inforced electrochemically. In most cases an artificial oxidation is unnecessary, if the intermediate insulating material between different layers is hygroscopic, if, for instance, asbestos is used, since sufficient moisture is then attracted from the air. If a less hygroscopic moisture is used it should be moistened with water when the coil is wound. With alternating current the formation of the insulating layer takes more time, and it is preferable to treat the finished coil for about 15 minutes with direct current. The strength of the current is so chosen that at the end of this time, the coils are at a temperature of about 110 degrees C. To get the same ohmic resistance, aluminum wire must be thicker than copper wire. But this does not mean that the dimensions of the coils themselves will be larger for aluminum than for copper. For thin wires up to about 1 mm this will at once be evident in view of there being no insulation. For thicker wires round copper wire must be used on account of the insulating cover, while with aluminum wire a rectangular cross-section may be employed which means a considerable saving in space. In calculating an aluminum coil it is to be considered that the temperature coefficient of aluminum is only 0.36 while that of copper is about 10 per cent larger. Moreover, aluminum coils (especially when the external layer is blackened by means of lacquer) cool more quickly than insulated copper wire coils. "The electrical conductivity of aluminum wire is from 28 to 33 per cent smaller than that of copper wire, so that the diameter of a round aluminum wire must be from 18 to 23 per cent larger than that of the copper wire." Such coils may be employed for dynamo-electric machinery, arc lamps, telephones, etc. A table is given of the dimensions of copper and aluminum wires, their resistance, weight, price, etc., and it is found that with aluminum the saving in weight amounts to from 50 to 60 per cent, and the saving in price from 25 per cent (for larger coils) to 59 per cent (for smaller coils). In the discussion Alving remarked that an aluminum coil as described above was tested and withstood a maximum e. m. f. of 30 volts between two adjoining turns. The installation was stable as long as the coil was in water. When it was taken from the water, there occurred soon small resistance variations which increased with increasing temperature. At the maximum temperature of about 600 degrees C. in the interior of the coil the insulation suddenly broke down. This is explained as follows: The insulating layer consists of the hydroxide which is stable at temperatures up to about 150 degrees C. At higher temperatures more or less water is gradually given off according to the condition of the surrounding atmosphere. At still higher temperature the insulating layer is suddenly destroyed, the hydroxide being changed into oxide which is no insulator. It is preferable to avoid temperatures above 100 degrees C. Water cooling is permitted and even desirable.—*Elek. Zeit.*, March 14.

*Enamel-Covered Wire.*—A note on a new kind of enamel-covered wire made in England. It is said that the manufacture of the best kind of this wire formerly made has been based upon oxidized oils, which are not durable, the oxodizing process not being permanently arrested when the wire leaves the factory, and which are not alkali proof, since in contact with alkalies some substance resembling soap is formed. The new enamel-covering is based upon a special treatment of stearine pitch. It is not an oxidizing process and can be carried out in a vacuum. The wires are said to be highly tenacious, flexible and uniform in thickness.—Lond. *Elec. Rev.*, March 15.

*Impregnating Wooden Poles.*—Petritsch.—An article on trials made by the Austrian Telegraph Department with various means for preserving wooden poles. Until recently they have used exclusively impregnation with copper sulphate by the Boucherie process. But the method was not fully successful. Creosote is a very much better agent for protecting wood against destruction. According to the Bethell process the wooden poles are carried on iron cars into large cast iron tanks and after evacuating the air the creosote is introduced into the tank and is pressed into the wooden poles. If this process is carried out until the wood will no longer absorb any creosote, the amount of creosote used per cubic meter of a certain kind of wood specially used in Austria for telegraph poles is not less than 300 kg. This means, of course, a great expense, and for this reason other processes have been devised in which the amount of creosote introduced into the wood is reduced to about one-third the amount mentioned above.. Other reagents are also discussed, and it is suggested to make further trials with zinc chloride. A superficial impregnation of wooden poles with mercuric chloride is quite effective, but the Austrian Telegraph Department has not used this method on account of the poisonous nature of the reagent. It is now suggested to impregnate the wooden poles superficially with other strong antiseptic agents.—*Elek. und Masch.*, March 10.

### Electro-Physics and Magnetism.

*Electronic Theory.*—J. J. Thomson.—A lecture delivered before the (British) Institution of Electrical Engineers in which the author gives a full review of the present status of the electronic theory as applied to the electric conductivity of metals.—Lond. *Elec.*, March 15.

*Determination of Power.*—Jakob.—An illustrated description of a graphical integration method for determining the power if the instantaneous values of voltage and current are given.—*Elek. Zeit.*, March 14.

*Solid Dielectrics.*—Malcles.—A French Academy note on an investigation in which he studied the gradual charge and discharge of condensers with various solid dielectrics. Commercial English paraffine with a melting point of 70 degrees C. is a perfect stable dielectric; that is, it shows neither the phenomena of overcharge nor of residual charge. This property may be usefully applied to the investigation of ordinary dielectrics.—*L'Industrie Elec.*, Feb. 25.

*Susceptibility of Mixtures of Salt Solutions.*—McLennan and Wright.—An account of some measurements made on the magnetic susceptibility of solutions of manganese, aluminum and copper sulphates in water, and several mixtures of these. It was hoped that the results of these measurements might be of service in explaining the behavior of the magnetic alloys made from non-magnetic metals and discovered by Heusler. The measurements, however, show that mixtures of these metallic salt solutions behave quite differently from the corresponding metallic alloys. In the alloys the presence of aluminum produces a very pronounced increase in the permeability of manganese, but no such action takes place when a mixture of solutions of the salts of these metals is used.—*Phys. Rev.*, March.

*Resonance Phenomena.*—Hemsalech and Tissot.—A note on a (French) Academy paper on resonance phenomena in the case of transformers with open magnetic circuits and on their application for the production of strong electric sparks.—*L'Industrie Elec.*, Feb. 25.

### Units, Measurements and Instruments.

*National Physical Laboratory.*—The first part of a summary of the work which has been done in 1906 in the (British) National Physical Laboratory. An important research related to wind pressure. The chief conclusion drawn from experiments on boards up to 100 sq. ft. in area, and on models of roofs and girders, is that the mean pressure per unit is in all cases about 18 per cent greater when measured on the large model than when determined in the experimental channel, described in previous reports, on similar small models. In other words, it would appear that the average pressure on a complicated structure may be determined by experimenting on a small model and increasing the value observed by some 20 per cent. The de-

termination of the specific heat of superheated steam and the research on the resistance of iron and steel to reversals of direct stress have been brought to a definite conclusion. In the electrical department, F. E. Smith has, in conjunction with Ayrton and Mather, completed his work on the ampere balance which was commenced three years ago, and is now ready for publication. The balance, which was built in the Laboratory, is giving the highest satisfaction, and the largest factor of error in the absolute determinations made are probably connected with the uncertainty of the exact value of *g*. In making the determinations—which on different days generally agree within 0.001 per cent—a current of one ampere nominal is maintained by keeping the potential difference steady on a 1-ohm standard resistor, and this potential difference is balanced against a cadmium standard cell. A complete series of observations may now be finished in from 20 to 30 minutes. Researches are also being carried out on the silver voltameter, the electrochemical equivalent of silver and the reliability of standard cells. The inductive capacity and resistivity of cellulose has been tested. In the electrotechnical division the new laboratories have been fitted up. The novel standard resistances of 20,000 megohms, constructed by Caspari, consist of U-tubes of glass, each 20 cm long and 1 mm bore, filled with a 10 per cent solution of cadmium iodide in amyl alcohol, into which cadmium electrodes dip. These tubes, each of 10 megohms, will carry heavy currents for 10 minutes; they are immersed in oil, and their temperature coefficient is 1.5 per cent per degree C. The water tube resistances of manganin are another interesting novelty; Melsom uses them for currents of 5000 amperes, and Harker in his furnaces for currents up to 1000 amperes.—Lond. *Eng'ing*, March 22.

*Guard Ring for Cable Testing.*—The uncertainty of obtaining the true DR value of a cable in wet weather, and the irregularity in the electrification arising from the accumulation of moisture during a prolonged test in damp and foggy weather or tropical rains, is obviated—so far at least as the surface leakage at the ends affects the test—by the employment of ebonite guard-ring, designed by J. Rymer-Jones and shown in Fig. 3. To secure reliable DR results, this guard ring is put on each end of the cable core to be tested and also on both ends of the testing lead which equally require protection against surface leakage. The insulating guard-ring has a central hole (0.5 in. in diameter) having a slight taper, and large enough to permit of its being drawn over any size of core likely to be tested. At a point about

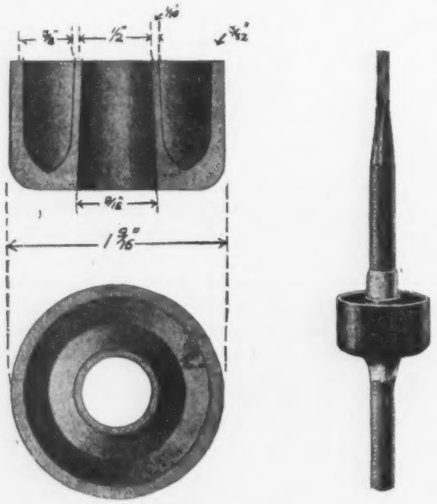


FIG. 3.—GUARD RING FOR CABLE TESTING.

8 in. from the end the core should be cleaned for one or two inches, by scraping or washing with naphtha on a clean rag, lamped and then coated with paraffin wax softened in the spirit lamp. As soon as the wax has cooled, one of the ebonite rings is drawn over the end and over the wax, so that the hardened wax entirely fills the space between the core and the ebonite ring. In the absence of paraffin wax, a strip of pure rubber may be lapped around the core to form a slight taper, over which the ebonite guard-ring may be secured by simply screwing it on.—Lond. *Elec. Rev.*, March 22.

*Measuring the Coefficient of Self-Induction.*—Zeleny.—The author describes the Maxwell-Rayleigh and the Anderson methods for the measurement of the coefficient of self-induction, together with modifications of these two methods. The experimental difficulty of the Maxwell-Rayleigh method for measuring the coefficient of self-induction is avoided by omitting the measurement with the small known resistance for distributing the balance in the Wheatstone network, and substituting for it the measurement of the current in the main circuit. The modified method presents for work of precision an advantage over all other known methods on account of a greater freedom from uncertain corrections. The Anderson null method is modified by the writer so as to render only the free charge of the condenser effective. It is shown, experimentally, to be capable of as high a degree of accuracy as the modified Maxwell-Rayleigh method. It possesses a slight disadvantage from a theoretical standpoint, is less sensitive, and requires a double balancing; but has the advantage of being a null method and of not requiring the measurement of several electrical quantities necessary in the employment of the other method. The modification of the Anderson method by the employment of a secohmmeter gives results varying appreciably with the rate of the alternations of the current.—*Phys. Rev.*, March.

*Localizing Faults.*—Fernie.—A summary of different methods of localizing a fault in a three-wire network and of special arrangements for facilitating such tests.—Lond. *Elec. Rev.*, March 15.

*Meters.*—Hundt.—An illustrated description of some electricity meters having some novel points in construction, exhibited by the Siemens-Schuckert Company at the Nuremberg exposition in 1906. Among them are several new constructions of direct-current meters, and several meters for special tariffs, especially double-tariff meters, maximum-demand meters, etc.—*Elek. Zeit.*, March 14.

## Gasoline Electric System for Commercial Vehicles.

The British Thomson-Houston Company, of Rugby, England, has developed a special form of gasoline-electric mechanism for propelling vehicles which possesses many interesting features. The system employed is one in which the transmission is entirely electrical and possesses the simplicity and flexibility of the electric control. Differential gears are eliminated by the use of two motors, which also allow the speed to be varied by the series-parallel method.

The generating equipment consists of a special form of dynamo directly coupled to a gasoline engine. The dynamo is of the automatic regulating type, designed to maintain a constant load on the equipment at a constant speed of the engine, irrespective of the varying load demands of the vehicle. In other words, the product of volts and amperes of the output is at all times constant, for as the ampere load demand increases (when the vehicle is climbing a grade) the volts correspondingly decrease in such a manner that the load and, therefore, the speed of the engine remains unaltered. This result is obtained entirely automatically, by a suitable arrangement, and design of the dynamo windings, and without the use of moving contacts. The dynamo is designed to be coupled to a 35-hp engine and is nominally rated at 15 kw, 850 r. p. m., 65 to 130 volts, but is capable of withstanding heavy overloads. It is enclosed with removable aluminum covers, which completely protect it from dirt and water.

Each motor is designed for a constant input of 7.5 kw at from 500 to 1400 r. p. m.; the e. m. f. varying from 65 to 130 volts; it is a series-wound machine. The two motors are capable of propelling a vehicle having a gross weight of seven tons up grades exceeding 14 per cent.

The system of control is extremely simple. To the right of

the driver, in the position usually occupied by the change-speed lever on a gear-driven vehicle, is mounted the "operating box," which is coupled through a chain to the controller proper. The latter is located in a convenient position close to the motors and generators, thus reducing the length of the connecting cables to a minimum. The controller provides two forward speed points corresponding to the series and the parallel connection of the motors, and one reverse speed point with the motors in series.

In the operating box is mounted a small resistance and control switch, electrically connected in circuit with the generator field coils. A foot pedal is arranged to be coupled to both the

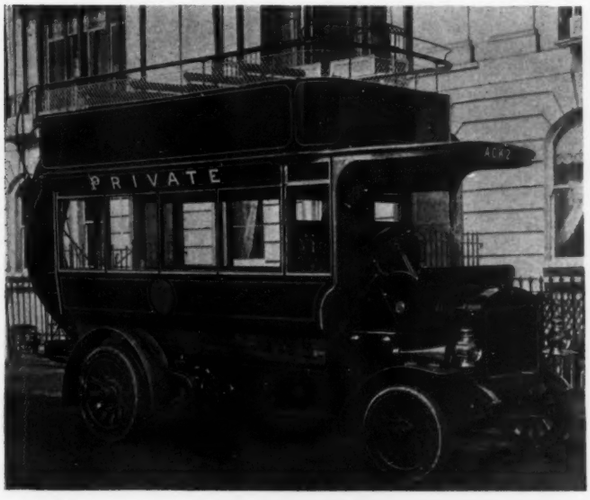



FIG. 1.—GASOLINE ELECTRIC MOTOR BUS.

engine governor and to the control switch, in such a manner that when the pedal is fully depressed the engine is governed to run at 400 r. p. m. and at the same time the switch is moved to insert in the generator field circuit a resistance sufficient to reduce the main volts to practically zero. No current, therefore, flows through the motors and the vehicle is stopped. On releasing the pedal the first movement cuts the resistance out of the generator field circuit, causing sufficient current to flow to the motors to start the vehicle, which will continue to run slowly, the engine remaining governed at 400 r. p. m. On entirely releasing the pedal the governor is "held up" allowing the engine speed at once to increase to 850 r. p. m. and the vehicle will accelerate to its full speed. The engine speed is prevented from exceeding 850 r. p. m. by the restraining influence of the generator, which exerts for all conditions of load a limited but definite load demand.

In order that the motors may exert the necessary additional torque in ascending a grade, the generator automatically supplies the required increase of current, but at a proportionately lower voltage. Thus the torque on the engine, and therefore its speed, remains unaffected whatever the grade may be, and this is brought about without any hand regulation on the part of the driver.

It should be observed that in this method of control, no main resistances are used to regulate the vehicle speed; there is, therefore, no power wasted in such resistances. The extra field circuit resistance mentioned is quite small, and under no condition absorbs more than 25 per cent of the power of the engine, and during normal running is cut out of circuit altogether.

An additional feature of the control is the stopping and restarting of the vehicle without operating the controller, and therefore without breaking the main circuit, thereby eliminating any possibility of sparking at the controller contacts. The vehicle is started with the motors in parallel; that is, with full speed connection.

The controller is operated only for reversing and in climbing grades exceeding 5 per cent, when better results may be obtained by running on the first forward series position. On the other hand, however, no damage can occur to the equipment if the driver neglects to change the speed.

A feature in the control which tends to economy in fuel is the arrangement whereby the driver is obliged to reduce the speed of the engine to 400 r. p. m. when the vehicle is standing, thus preventing the practice of racing the engine with the vehicle stationary.

For cases where it is necessary to travel for long distances at reduced, but constant speeds, and it is not convenient to regulate by the foot pedal, a hand lever is provided which independently controls the engine speed and allows the pedal to be released.

Under certain circumstances, as for example, when climbing steep grades, it is desirable to accelerate the engine speed for short periods in order to obtain the maximum power available. This is provided for by coupling the hand lever to the field circuit switch in correct sequence, in such a manner that, after the hand lever has been moved to a position corresponding to a normal engine speed of, say, 850 r. p. m., a further movement inserts a portion of the field rheostat, which changes the load demand of the generator and permits the engine to increase in speed, thereby delivering to the generator, and thus through the motors to the road wheels, its maximum available power. By this means full advantage can be taken of the additional power that may be obtained by running the gasoline engine for short periods above normal speed.

The question of rapid and smooth acceleration of a motor-bus, when a maximum speed limit is enforced, and where constant stops are necessary, is of the greatest importance and may even have an important bearing on earning capacity—the loss of a few seconds while accelerating after each stop, when the average service involves several hundred stops per day, may readily result in a loss of as much as one hour running time per day.

In the control system here described, the acceleration is both smooth and rapid; it is also automatic and does not depend on the skill of the driver, as is the case when a clutch and gear-box

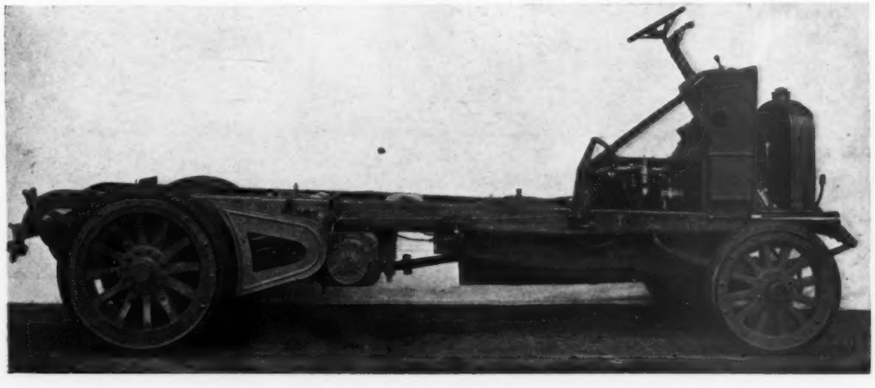


FIG. 2.—CHASSIS OF GASOLINE ELECTRIC VEHICLE.

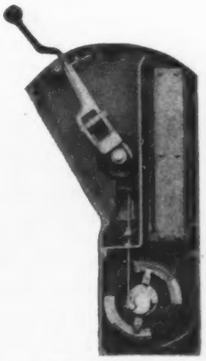


FIG. 3.—INTERIOR VIEW OF CONTROLLER BOX.

are used. A driver who has been taught to steer can immediately drive a vehicle fitted with this system as efficiently and economically as one who has had long training and experience.

On referring to the description of the control it will be seen that in order to stop the vehicle the dynamo volts are reduced to zero. Conversely, it follows, that in restarting the volts start from zero and increase to their maximum in regular progression as the vehicle accelerates. This ensures a perfectly smooth starting effort, and no shock can result at starting due to a careless or inexperienced driver releasing the pedal too suddenly. The action of releasing the starting foot pedal fully opens the engine throttle valve, and the engine at once attains its normal speed of, say, 850 r. p. m. The dynamo load prevents the engine exceeding this speed, the latter is, therefore, developing its full power, which is converted by the dynamo and delivered to the motors in the correct proportion of volts and amperes corresponding to the speed of the vehicle at that particular moment. As the vehicle continues to accelerate, this proportion continually varies automatically, the amperes decreasing and the volts increasing, the product of the two resulting in a constant quantity representing the full power of the engine. The engine is, therefore, developing its full power at a constant speed, during the whole of the acceleration period, and the resultant rate of acceleration is limited solely by the power of the engine, and not by the skill of the driver. As soon as the starting pedal is released, the acceleration becomes automatic, and the maximum available power is delivered to the road wheels without any loss due to slipping of clutch or reduced engine speed. Fig. 4 shows an acceleration curve taken from a record made by a Boyer speed recorder on a 24-hp vehicle fitted with the above-described system, weighing six tons with its load. The maintenance of the electrical equipment is practically limited to brush renewals, which form a very small item. The general maintenance of electrical machinery

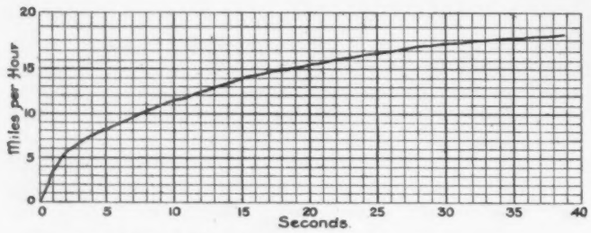



FIG. 4.—ACCELERATION CURVE ON A LEVEL MACADAM ROAD.

is well known to be small, and the design of these equipments has been carefully considered with a view to reducing maintenance to a minimum. The smooth starting effort will effect a considerable saving in maintenance on tires, chains and transmission gear generally. It is impossible to subject the engine to sudden shocks, and these, therefore, cannot result in broken crank shafts, as is often the case with the clutch and gear-box drive.

The efficiency of the equipment has been demonstrated by comparative tests with gear-driven vehicles. From the results of these tests it is claimed that a higher average speed can be maintained on a given route, with a given number of stops, and with less fuel consumption than with a gear-driven vehicle of similar type and of equal power and weight. This is due in the first place to a more efficient transmission and, secondly, to the absence of a definite relation between the engine speed and the speed of the vehicle, which renders it possible when running on a good, level road to run the engine at a comparatively low speed, and yet maintain a comparatively high vehicle speed.

## Induction Motor Trolley Hoist.

Fig. 1 herewith shows a hoist brought out by the Sprague Electric Company, of 527 West Thirty-Fourth Street, New York, equipped with a two or three-phase induction motor and attached to a plain trolley carriage. The motor *M*, is arranged with a comparatively large clearance between the rotor and stator to provide against unbalancing the rotor on account of the wear of the bearings. The gearing is enclosed in the box *D* (Fig. 2) which forms one end of the hoist frame. The gears are of cast iron and grease lubricated and the pinions are of machine steel.

The hoist is provided with two brakes; one, an ordinary mechanical or "tongs" brake operated by a cam attached to the controller shaft, and the other a load brake of the disk type, mounted on the armature shaft. The former brake is lifted from the pulley when the hoist is in operation and presses against the pulley with maximum force when the controller is on the "off" position. The latter brake works only when the hoist is lowering and is provided with a roller pawl which permits the friction disk to turn freely when the hoist is lifting its load. The friction depends on the tension of a spring, and this is adjusted to sustain the rated load regardless of the action of the mechanical brake, so that were the latter to fail the load brake would hold the load.

The limit switch consists of a screw on which is mounted a movable and two stationary nuts. On the end of the screw is a small sprocket wheel and on the end of the controller shaft is another, both being connected by a chain gear. When the mov-

FIG. 1.—INDUCTION MOTOR TROLLEY HOIST.

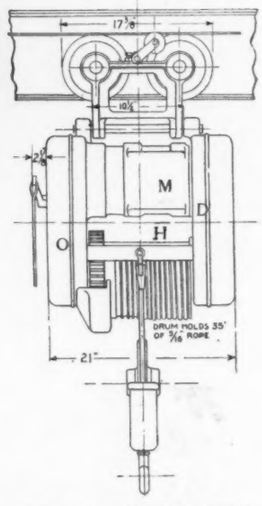



FIG. 2.—INDUCTION MOTOR TROLLEY HOIST.

ing nut engages the stationary nut at either end, the sprocket wheel is rotated and the controller turned to the "off" position, which causes the brake to act and stop the hoist. The mechanical brake, the limit switch mechanism and the load brake are all contained within the case *O*.

The drum is of the full diameter specified by the manufacturers of the rope and the sheave is of the same diameter as the drum. The controller is mounted between the end frames and is fitted with a sheet metal cover *H*. The controller is of the cylinder type and gives one hoisting and one lowering speed. Compressed grease is used throughout for lubrication.

The trolley carriage is adapted to run on the lower flange of the standard I-beam. The tread of the wheels is spherical, the wheels touching only at a single point so that curves are easily rounded. The company also supplies a hand-geared carriage which is provided with a hand chain and gear wheel, the gears being cut directly on the flanges of the trolley wheels.

# Industrial and Commercial News

## Commercial Intelligence.

THE WEEK IN TRADE.—The seasonable weather had a good effect upon trade, and the distribution of spring merchandise was fully up to expectations. Country merchants are purchasing liberally at wholesale in the leading centers. Trade reports from the principal cities are uniformly favorable, active business being accompanied by further improvements in collections. Reports from most leading industries are still of full order books and of backward deliveries. There is, however, slightly more manifest a disposition to move conservatively as regards distant dates, some easing of metal quotations and a softening of asking prices for various products, and the jewelry, shoe, leather and wool trades note quiet, pending a clearer view of later developments. The demand for lumber and other materials increases as open weather stimulates building operations. Leading industries are fully occupied, and no strikes of more than local significance have materialized thus far. Manufacturers are busy on goods for early shipment, and sample business for later seasons promises continued activity. Improved traffic conditions make deliveries more prompt, and railway earnings in three weeks of March were 10 per cent larger than last year. Current conditions in business are best indicated by the statement for the latest month and liabilities of failures in March were smaller than in either preceding month this year or the same month of any year since 1902. Steel-making iron was active. The only complaints about a slackening of business are heard from a few small founders who work for speculative builders, which interest is depressed by recession of the high tide of speculative building in the suburbs of a score of cities. Copper declined ¼ cent for lake, to 24¾ cents, which brings the metal more than ¾ of a cent below the market quotation of ten days ago. At the close of the week the market became stronger and the loss was recovered. The larger sales of the week by local producers were at 25¼ to 25½ cents for electrolytic under July shipments. High grade lake was active at 26 and 26½ cents for July. Prime casting copper, sixty days, was at 25 and 25½c.

NORTHERN CALIFORNIA POWER.—At the recent annual meeting of the Northern California Power Company, held in San Francisco, President H. H. Noble made the following statements in his annual report: "I am glad to report that the past year has been a very prosperous one for our company, although the disaster of April 18, 1906, interfered very materially with the realization of the expectations expressed in my last annual report. The water wheels for the new 3000 horsepower plant were delayed in delivery and some of our customers had trouble in getting their machinery. Notwithstanding these delays, our net income has increased from $75,414.40 in the previous year to $96,243.37 for the last year, being a net gain of $20,828.97. We have connected our Kilarc and Volta power-houses with a high-tension line of 16 miles in length, and have nearly completed a storage reservoir at Buckhorn Lake. This, with a ditch which we are now constructing to connect Canyon Creek with our main ditch system, will help to insure a continuous supply of water for the Kilarc plant. The Battle Creek Power Company, a subsidiary company of the Northern California Power Company, is installing a large storage reservoir at McCumber Flat. It is actively at work constructing a plant on Battle Creek of 12,500 horsepower capacity, and I hope to have it finished and running before the next annual meeting. The contracts for the water-wheels have already been let to the Pelton Water Wheel Company and the generators to the Westinghouse Electric and Manufacturing Company." The company is experimenting with the Heroult process of electrical smelting of iron ore.

ROAD MOTOR CARS.—A committee of Pennsylvania Railroad officials have reported on the use of road motor cars as adjuncts to regular track service. They exhibited the European systems in person, and say: "It was noted that wherever steam has been used for the operation of road motors they have proven unsatisfactory, and that gasoline machines are the most successfully operated, those of the Milnes-Daimler type predominating. From our personal observation and the information obtained as to the conditions existing under which road motor service has been established and operated in Great Britain, and with our knowledge of the general condition existing in the territory traversed by our line, it is the opinion of your committee that the establishment of this character of service as an adjunct to our railway passenger business is not worthy of any serious consideration at this time, and it is our judgment that the same cannot be successfully or profitably operated, on account of the general bad condition of the roads, severe climate and the territory not at present covered by trolley lines being so sparsely settled as to make such service unnecessary and unwarranted." They speak somewhat more hopefully of rail motor cars, but are not very enthusiastic about them.

THE SOUTHERN POWER COMPANY, with headquarters in Charlotte, N. C., a few days ago posted a notice on the bulletin board at Great Falls, S. C., announcing the discharge of approximately 400 men employed at the Rocky Creek and Great Falls stations. The enforcement of the order left but 100 men to look after the work under way. The majority of those discharged were employed in clearing away the débris from the site of the Rocky Creek development. This action was due to the fact that the Southern Power Company found money scarce at this season and decided to curtail the immense development which it now has under way at a number of points. While operations at Rocky Creek station, a few miles below Great Falls station, have been practically abandoned, this does not mean that the work at Ninety-Six Islands has also been suspended. On the contrary, it is being pushed there.

NEW TAP AND DIE FACTORY.—On March 19, 1907, the J. M. Carpenter Tap and Die Company, of Pawtucket, R. I., broke ground for its new factory. The building will be of brick construction, practically fireproof, covering 24,000 square feet of floor space, and increasing its manufacturing facilities 75 per cent. While the company has been reasonably prompt in filling orders, it expects by its increased facilities to serve its patrons better in the future, and will be able to fill promptly all requirements in its well-known line of tools for cutting screw threads, including taps, dies, die stocks and tap wrenches. This company started in business 37 years ago and is the pioneer machine screw tap makers of this country, having first put the machine screw tap on the market and its taps have maintained their high standard quality and been acknowledged standard for nearly half a century.

PLANTS ON THE RHINE.—U. S. Consul-General Richard Guenther, of Frankfort, reports that two large electric-power stations are to be erected along the river Rhine at Augst-Wyhlen, each with 15,000 horsepower. One of the power stations is to be located on the Swiss shore, the other on the German side of the river. The company erecting the works pays $13,124 to the Swiss Canton for the concession, also an annual tax of $17,254, besides supplying 5260 horsepower of electrical energy at cost price to the Canton authorities. The company also obligates itself to pay $24,125 toward the erection of a new bridge over the Rhine.

STACKPOLE BATTERY COMPANY.—The Stackpole Battery Company, of St. Marys, Pa., manufacturer of dry batteries, carbon products, etc., has started a large addition to its extensive plant and is now working two shifts, night and day. With its new facilities it hopes to meet all demands, and to handle an output second to none in the country. Mr. W. J. Mills is the superintendent.

WIRELESS PLANTS.—The new turbine steamers "Yale" and "Harvard," of the Consolidated Steamship Lines (Metropolitan service) to ply between New York and Boston, are to be equipped with the De Forest system of wireless telegraphy.

BOSTON ELEVATED MOTOR ORDER.—The Boston Elevated Railway has given an order for 400 General Electric motors, rated at 50 hp at 600 volts, and heavy auxiliary pole windings, the weight of each motor being 2700 lbs.

## Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market exhibited greater strength throughout the week and there was an almost unbroken upward movement. The result of the Chicago municipal elections, the decision of the Supreme Court of Minnesota in the suit to restrain the Great Northern Railway stock issue, the settlement of labor difficulties on the Western railways and the bright outlook for the crops combined with the immense improvement in the money situation to produce a more cheerful feeling in Wall Street. Meanwhile the reports of the commerical agencies show that business throughout the country is in the soundest and most vigorous state. At the close the market became quieter. Some substantial gains were made in the electric and traction stocks, and considerable strength was shown. At the close of the week Brooklyn Rapid Transit recorded a gain of 9½ points, Interborough-Metropolitan 2½ and 2¾ for common and preferred; Metropolitan Street Railway, 4; Allis-Chalmers preferred, 6½; General Electric, 4; American Telephone and Telegraph, 2; New York and New Jersey Telephone, 2¼; Western Union, 1⅜. The curb market recovered in sympathy with the exchange list. Nearly everything moved up, with Standard Oil leading at an advance of some 15 points for the week. The pools in most of the mining stocks were again at work, United Copper scoring a sharp gain and Nipissing doing likewise. Following are the closing quotations of April 9:

NEW YORK.

| | April 2 | April 9 | | April 2 | April 9 |
|---|---|---|---|---|---|
| Allis-Chalmers Co. | 11 | 12½ | General Electric | 145 | 148½ |
| Allis-Chalmers Co. pfd. | 27½ | 35 | Hudson River Tel. | .. | .. |
| American Dist. Tel. | .. | .. | Interborough Met. com. | 25 | 26¼ |
| American Locomotive | 62⅞ | 65 | Interborough Met. pfd. | 61 | 60 |
| Amer. Locomotive pfd. | 105 | 105 | Mackay Cos. | .. | .. |
| American Tel. & Cable. | 75 | 75 | Mackay Cos. pfd. | .. | .. |
| American Tel. & Tel. | .. | .. | Marconi Tel. | .. | .. |
| Brooklyn Rapid Transit | 58¾ | 61½ | Metropolitan St. Ry. | .. | .. |
| Electric Boat | 32 | 28 | N. Y. & N. J. Tel. | .. | .. |
| Electric Boat pfd. | 80 | 78 | Western Union Tel. | 81½ | 82¼ |
| Electric Vehicle | .. | .. | Westinghouse com. | 147 | 145 |
| Electric Vehicle pfd. | .. | .. | Westinghouse pfd. | .. | .. |

BOSTON.

| | April 2 | April 9 | | April 2 | April 9 |
|---|---|---|---|---|---|
| American Tel. & Tel. | 119¾ | 122½ | Mass. Elec. Ry. pfd. | 60¾ | 59¾ |
| Cumberland Telephone. | .. | .. | Mexican Telephone | .. | .. |
| Edison Elec. Illum. | 208 | 208 | New England Telep. | 117 | 118½ |
| General Electric | 147 | 150 | Western Tel. & Tel. | 6 | 6 |
| Mass. Elec. Ry. | 17 | .. | West. Tel. & Tel. pfd. | .. | 70 |

PHILADELPHIA.

| | April 2 | April 9 | | April 2 | April 9 |
|---|---|---|---|---|---|
| American Railways | 48½ | 49¼ | Phila. Electric | 8½ | 8⅞ |
| Elec. Co. of America | 9⅝ | 10⅛ | Phila. Rapid Trans. | 16¼ | 16¾ |
| Elec. Storage Battery | 52 | 55 | Phila. Traction | 92 | .. |
| Elec. Storage Bat. pfd. | .. | .. | | | |

CHICAGO.

| | April 2 | April 9 | | April 2 | April 9 |
|---|---|---|---|---|---|
| Chicago City Ry. | .. | *200 | National Carbon | .. | 72 |
| Chicago Edison | .. | .. | National Carbon pfd. | .. | *110 |
| Chicago Subway | .. | 80 | Union Traction | .. | .. |
| Chicago Tel. Co. | .. | .. | Union Traction pfd. | .. | .. |
| Metropolitan Elec. com. | .. | 22 | | | |

*Asked.

MARCONI WIRELESS REPORT.—The Marconi Wireless Telegraph Company of America has issued a financial statement for the year ended Jan. 31, 1907. The general balance sheet is as follows:

ASSETS.

| Jan. 31. | 1907. | 1906. | 1905. | 1904. |
|---|---|---|---|---|
| Patent rights, good will, etc. | $5,473,364 | $5,473,364 | $5,468,494 | $5,318,494 |
| Stations and exp. work | 142,461 | 160,525 | 204,423 | 175,606 |
| Apparatus on hand | 17,709 | 26,668 | 15,906 | 14,770 |
| Accounts received | 24,131 | | 14,840 | 31,088 |
| Cash | 9,626 | | 54,581 | 22,114 |
| Treas. stk. | 151,200 | 290,000 | 290,000 | 582,760 |
| Fur and fixtures | 1,178 | 1,291 | 1,178 | 1,216 |
| Org'n exp. salaries, etc. | 384,804 | 157,475 | 168,843 | 85,183 |
| Insur. unexp. | 577 | 617 | ..... | ..... |
| Total | $6,053,850 | $6,209,939 | $6,218,264 | $6,231,232 |

LIABILITIES.

| | | | | |
|---|---|---|---|---|
| Capital stock issued | $6,038,800 | $6,190,000 | $6,190,000 | $6,190,000 |
| Accounts payable | 5,450 | 5,539 | 9,064 | 17,232 |
| Notes payable | 9,600 | 14,400 | 19,200 | 24,000 |
| Total | $6,053,850 | $6,209,939 | $6,218,264 | $6,231,232 |

The report of the directors says in part as follows: "The commercial work of this company continues to show improvement, and it is gratifying to note that during the past fiscal year, the station and steamship receipts show an increase of $22,961 over those of the previous year, while the station and steamship expenses show an increase of only $6,106. There are now, of ocean going steamers, trading between America and the continent, 78 vessels equipped with the Marconi short distance apparatus which enables them to communicate with shore stations on the North American continent, and in Europe up to distances of 250 miles, and at the same distance with each other; while seventeen carry our long distance apparatus and may be communicated with during their entire voyage across the Atlantic. These latter ships publish daily newspapers containing the latest news of the day compiled by the Associated Press in America and Reuter's Agency in Europe, the wireless transmission being effected by this company's high-power station at South Wellfleet, Mass., and the similar station of our affiliated English company at Poldhu, England. In addition to this, negotiations pending for some time are now about complete whereby the number of the mercantile fleet bearing the Marconi system will be largely increased."

GREAT NORTHERN POWER.—Advices from Boston point out that the proposed construction of a new steel plant at Duluth for the manufacture of steel rails and bars will prove of incalculable benefit to the Great Northern Power Company, which is financed by Tucker, Anthony & Co., of Boston, and C. D. Barney & Co., of New York. This company was formed with a capitalization of $5,000,000 of 5 per cent bonds, $2,000,000 of 6 per cent preferred stock, and $6,500,000 of common stock to harness the St. Louis River at Duluth for the ultimate development of 80,000 horsepower in water power. Its immense plant at Duluth, which has been under construction for the past year is approaching completion, and the current has been turned on and the delivery of commercial power started. The company's dams and canals are of a capacity for 80,000 horsepower. Machinery has been installed for about 30,000 horsepower and contracts have already been signed with the street railways, light, power and manufacturing companies for 20,000 horsepower. The returns from the sale of 20,000 horsepower will be sufficient to pay all operating expenses, fixed charges, and the 6 per cent dividends on the $2,000,000 of preferred stock, and the company will still have 10,000 horsepower to dispose of. The erection of a $10,000,000 steel plant at Duluth, by the U. S. Steel Corporation, will create a market for about 10,000 additional horsepower and will necessitate installation of additional machinery.

DIVIDENDS.—Directors of the Manchester Traction and Light Company, of New Hampshire, have declared the regular quarterly dividend of 1½ per cent on the capital stock, payable April 15. Directors of the Edison Electric Illuminating Company, of Boston, have declared the regular quarterly dividend of 2½ per cent, payable May 1. Directors of the New England Telephone and Telegraph Company have declared the regular quarterly dividend of 1½ per cent on the capital stock, payable May 15. Directors of the Brooklyn City Railroad Company have declared the regular quarterly dividend of 2½ per cent. payable April 15. Directors of the Georgia Railway and Electric Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable April 20. They have also declared a stock dividend of 33 1-3 per cent on the common, payable in common stock at par on May 20. Directors of the Lincoln Traction Company, of Nebraska, have declared the regular quarterly dividend of 2½ per cent on the common stock, payable April 15. The regular quarterly dividend of 1¼ per cent on the preferred stock of the New Orleans Railway and Light Company is payable April 15.

HAVANA ELECTRIC REPORT.—The report of the Havana Electric Company for the year ended Dec. 31 shows as follows:

| | 1906. | 1905. | 1904. |
|---|---|---|---|
| Gross | $1,621,209 | $1,504,837 | $1,247,486 |
| Extra tax, etc. | 1,031,373 | 776,052 | 724,746 |
| Net | $589,836 | $728,785 | $522,740 |
| Other income | 40,863 | 38,033 | 23,138 |
| Total income | $630,699 | $766,818 | $545,878 |
| Charges | 498,313 | 395,897 | 408,270 |
| Surplus | $132,386 | $370,921 | $137,608 |
| Preferred dividends | 200,000 | ..... | ..... |
| Deficit | $67,614 | *$370,921 | ..... |
| Previous surplus | 509,073 | 138,152 | ..... |
| P. & L. surplus | $441,459 | $509,073 | ..... |

*Surplus.

WEST END RAILWAY.—The Massachusetts Railroad Commissioners have authorized the West End Street Railway Company, of Boston, to issue 8,400 shares of new capital stock, par $50 per share, making a total of $420,000, to defray the cost of permanent additions.

# GENERAL NEWS

## Construction News.

ESCONDIDO, CAL.—I. F. C. Wheaton and associates have petitioned for an electric light and power franchise. A company will be formed under the name of the Escondido Electric Light & Supply Company and will supply electricity for light and power in this city.

EUREKA, CAL.—George Heazleton, of San Francisco, has secured control of the street railway system of the Humboldt Transit Company in this city. The plans of the new company include an extension of 14 miles around Humboldt Bay to Arcata, and possibly to Scotia.

NAPA, CAL.—Application has been made by Henry Brown to the Board of Supervisors for a 45-year franchise to erect and maintain wires for transmitting electricity for heat, light and power. Bids for the above franchise will be received until April 24.

PLACERVILLE, CAL.—J. B. Manardi has appropriated 12,000 miners' inches of water flowing in Weaver Creek, to be used to develop power at the intersection of the creek with the South Fork of the American River.

RED BLUFF, CAL.—H. P. Stice has filed on 10,000 ins. of water in Mill Creek to be diverted at Squires Marsh. M. O. Ballard, who is connected with the Pacific Power Company, has also filed on 20,000 ins. to be diverted near the Avery foot bridge. Both applications are made for the purpose of securing power to generate electricity.

SAN FRANCISCO, CAL.—A meeting of the stockholders of the Big Creek Light & Power Company will be held April 23, for the purpose of voting on the question of issuing $339,000 in bonds.

SAN FRANCISCO, CAL.—A New York director of the Western Power Company is quoted as saying that his company will erect a steam power plant in San Francisco or Oakland involving an expenditure of perhaps $2,000,000.

SAN FRANCISCO, CAL.—The San Francisco Coke & Gas Company has decided to change its name to the Metropolitan Light & Power Company and to increase its bonded indebtedness from $2,500,000 to $7,500,000 for the purpose of allowing an extension of the company's mains, adding to the gas plant, and also to install a plant to furnish electricity throughout San Francisco. Leopold Michels is president.

SANTA CRUZ, CAL.—The Coast Counties Power Company is erecting a steam power house in Santa Cruz to supply local demands. The plant will have an ultimate capacity of 4000 horse-power. A 900-hp turbo-generator unit will be installed at first. P. H. Sterling is local manager.

SONORA, CAL.—A. H. Kleinecke has been granted a franchise to operate an electric railway on the principal highways of the county by the Board of Supervisors of Toulumne County. The amount paid for the franchise was $375.

CANON CITY, COLO.—The Colorado Telephone Company is considering a number of extensions to its cable service in this city, and will expend $5,000 in improvements.

PALISADES, COLO.—The plant of the Palisades Light, Heat & Power Company was recently destroyed by fire, entailing a loss of about $7,000.

SILVERTON, COLO.—W. E. Lloyd, superintendent of the Hamlet Mine, is making extensive improvements to the property, among which is the installation of electrical machinery for operating the mines.

GUILFORD, CONN.—The Morris Cove & East Haven Company has applied to the Legislature for a charter to build an electric railway from East Haven to Guilford.

NEW LONDON, CONN.—It is said that the Consolidated Railway Company has under consideration the construction of a power plant at Thamesville, in the near future, to furnish electricity for operating the railway systems in New London, Montville, Norwich and Willimantic.

WASHINGTON, D. C.—Following a conference with the officials of the Potomac Electric Power Company, held recently, regarding the placing underground of all service wires for buildings, Electrical Engineer Allen has decided that such a regulation could not be enforced and has recommended that a single three-conductor cable be substituted for the present system of open wires. Commissioner Macfarland has approved the recommendation.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 23, to furnish at the navy yards, etc., Portsmouth, N. H., Boston, Mass., New York, N. Y., League Island, Pa., Annapolis, Md., Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 574—fire alarm systems, wire, electrical supplies. Schedule 576—ventilating sets, annunciators, etc. Schedule 578—motors, etc. Also until April 30, to furnish at the navy yards at Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies as follows: Schedule 608—electric conductor, etc. Schedule 609—voltmeters, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster General, U. S. N.

ALBANY, GA.—Smith D. Pickett, of Albany, president Albany Power & Manufacturing Company, writes that bids will probably be received about June 1 or July 1 for the proposed plant, which will cost about $600,000. J. E. Sirrine, of Greenville, S. C., is engineer.

ATLANTA, GA.—The Georgia Electric Railway Company, which controls the street car and electric lighting systems of Atlanta, has increased its capital stock from $6,000,000 to $8,500,000. Two millions of this was in the form of a 33 1-3 per cent dividend to stockholders, and $500,000 was added as treasury stock, to be sold for extraordinary expenditures and improvements.

ATLANTA, GA.—Work will commence on the construction of the new electric railway to Buckhead in the early part of the summer. The line will be an extension of the present line to Brookwood and will be built by the Georgia Electric Railway Company. The incorporators of the Georgia Electric Railway Company are: P. S. Arkwright, G. W. Brine, Thomas K. Glenn, W. H. Glenn, H. N. Hurt, S. E. Simmons, R. E. Cullinane, W. B. Stovall, F. M. Sisk and W. H. Wright.

BRUNSWICK, GA.—The City Council on March 22 passed an ordinance and contract, granting to Mr. F. D. M. Strachan and associates, a 40-year franchise for an electric railway system and lighting plant. The contract is for a term of 10 years, to supply the city with arc lamps at $75 per year for the first hundred lamps, with a rate of $65 after 300 are used. Electricity will be furnished at 11 cents per kw-hour for light and 7½ cents for power. Incandescent lamps of 32 cp will be substituted for street gas lamps at a price ranging from $10 per year to $18 per lamp per year. In consideration of the franchise, Mr. Strachan and his associates have agreed by contract to purchase and turn over the present waterworks plant of the Mutual Light & Water Company to the city at an arbitrated value. The city will pay for the plant at the rate of $10,000 per year.

CEDARTOWN, GA.—The question of constructing an electric railway to connect the cities of Cedartown, Rome, Rockmart, Aragon and Cove Springs is being considered by the citizens of this place. Dr. William Bradford and E. B. Russell are interested in the project.

COLUMBIA, GA.—The Swift Spinning Mill Company has contracted for 450 hp from the Columbus Power Company, Columbus, Ga., from the Chattahoochee development. The electricity will be used to operate the new cotton mill of the company.

CŒUR DE ALENE, IDAHO.—The Interstate Telephone Company is contemplating an expenditure of $30,000 for improvements and extensions to its plant and system in this place.

NEZ PERCE, IDAHO.—At a recent meeting of the stockholders of the Nez Perce Co-Operative Telephone Company it was voted to increase the capital stock from $10,000 to $25,000, the proceeds to be used for improvements and extensions of the plant and lines of the company. It is said that the company will be absorbed by the Pacific States Telephone Company in the near future.

WALLACE, IDAHO.—Plans are now being perfected for the organization of the Inland Power Company for the purpose of erecting a power plant on Big Creek. The incorporators are: Stephen P. Wright, of Butte, Mont.; G. Scott Anderson, of Wallace; Maurice W. Bacon and William H. Hall, of Butte, Mont., and James J. Maloney, of Chicago, Ill. The capital stock is fixed at $300,000.

CAIRO, ILL.—The City Council has granted the Cairo Electric & Traction Company a franchise to operate a street car line on Washington Avenue in this city. A franchise was also given the Southern Illinois Interurban Company into Cairo.

GALENA, ILL.—The Dubuque & Southwestern Wisconsin Railway Company, Madison, Wis., has purchased the municipal electric lighting plant in this city, with a contract for lighting the city for a term of 25 years. The municipal plant has been in operation several years and has proved an unprofitable investment. The new company agrees to furnish twice as much light as the city did at only a 10 per cent increase in the present price. A. O. Fox, of Madison, Wis., is interested in the company.

GRIDLEY, ILL.—The Council is stated to be considering the establishment of an electric light plant.

PINCKNEYVILLE, ILL.—W. H. Smith, E. R. Hincke and Wm. L. McCandless have assigned the franchise recently secured from the city permitting them to erect an electric lighting system to the Pinckneyville Light, Ice & Power Company.

EVANSVILLE, IND.—The City Council has decided that the electric and telephone wires shall be placed under ground on certain portions of Main Street.

GALVESTON, IND.—The Town Board is ready to consider propositions for the erection and equipment of an electric light and power plant in the city. The board does not contemplate municipal ownership of the plant.

GREENFIELD, IND.—The City Council has authorized the Mayor and Board of Public Works to contract for $27,500 worth of new machinery and equipment for the municipal electric light plant. The plant is to be entirely reconstructed.

INDIANAPOLIS, IND.—The J. C. Dunn Company has incorporated to construct a plant to manufacture and install water, heating, lighting and power plants. Willis S. Dunn is president.

INDIANAPOLIS, IND.—The Indiana State Board of Forestry has granted the Indianapolis & Louisville Traction Company a right of way through the forest reservation near Henryville, 18 miles north of Jeffersonville. The amount of ground asked for is three and one-quarter acres. J. E. Greeley and Charles Lewis, of Louisville, Ky., are interested in the line.

LA PORTE, IND.—Edward J. Weddel has been appointed receiver for the Edwards Electric Headlight Company of this city. The application was made by the La Porte Electric Company as creditor. The Edwards Company is capitalized at $150,000, and manufactures gas and gasoline engines and electric headlamps for locomotives.

NEW CASTLE, IND.—Ambrose Petty, who recently acquired the holdings of the New Castle Light, Heat & Power Company, has purchased a new site and will erect a large power plant for commercial lighting and power purposes. The capacity of the plant will be sufficient to supply adjacent towns.

NEW PARIS, IND.—The New Paris Mutual Telephone Company has increased its capital stock from $2,500 to $10,000. Daniel J. White is president.

RUSHVILLE, IND.—Bids will be received by S. G. Gregg, city clerk, until April 30 for two water-tube type boilers of 250-hp each to carry 160 lbs. of steam pressure for the water and light plant.

SPEED, IND.—The stockholders of the Speed Telephone Company have decided to increase the capital stock from $6,050 to $10,000.

WANATAH, IND.—J. V. Dorland, president of the La Porte Telephone Company, has closed a deal with B. E. Sherman for the purchase of the Wanatah telephone exchange.

SAPULPA, I. T.—The City Council has granted a franchise to Schmidt and Reynolds for an electric railway from Sapulpa to the oil fields. The road will be eight miles in length.

SULPHUR, I. T.—W. Lyle Dickey, of Tulsa, acting for an Eastern syndicate, has been granted a franchise to build and operate an electric railway system in this city.

BURLINGTON, IA.—The Iowa Telephone Company is making extensive improvements and extensions to its system in this city. The exchange is being rebuilt, a new switchboard will be installed and the wires will be placed underground in the business section of the city.

CEDAR RAPIDS, IA.—A reduction of 7 per cent in the price of electricity for light and power, to take effect April 1, 1907, and a further reduction of 8 per cent, to take effect Jan. 1, 1908, has been agreed upon by the Cedar Rapids & Iowa City Railway & Light Company, and the light and water committee of the City Council. It is expected that the ordinance making the reductions will be passed at the next meeting of the City Council.

CLINTON, IA.—The Iowa Telephone Company is contemplating an expenditure of about $100,000 in rebuilding its exchange and erecting a new office building in this city, for which plans have already been prepared.

DES MOINES, IA.—Plans have been completed by the Iowa Telephone Company for the expenditure of several hundred thousand dollars for improvements and extensions to the company's lines in this state. About $60,000 will be expended in Des Moines for an addition to the switchboard, placing its wires underground and extensions to its system in the city. The exchanges at Iowa City, Carroll, Cedar Falls and Atlantic will be rebuilt at once. About $40,000 will be spent in the four cities. E. B. Smith is vice-president and general manager.

LAKIN, KAN.—Messrs. Waterman and Thorpe have secured an electric light franchise from the City Council and propose to install a plant of 600 or 800-lamp capacity and will furnish electricity for lighting the streets and residences in this city.

LAWRENCE, KAN.—The City Council has granted a franchise to the Lawrence Transportation Company to construct and operate an electric railway in this city. The franchise is for a term of 20 years.

LYONS, KAN.—G. A. Monroe and D. Chapin have purchased a controlling interest in the Lyons Electric & Manufacturing Company. The new owners contemplate enlarging the plant. H. V. Forest, the former manager, will leave in a short time for eastern Kansas, where it is understood he has purchased a similar plant.

PARSONS, KAN.—The Parsons Electric Light & Power Company has been awarded the contract for lighting the streets and city institutions for a period of five years.

BOWLING GREEN, KY.—Surveys and plans have been made by the Green River Hydro-Electric Company of this city for the construction of a power plant of 1000 hp at Glenmore, about 12 miles down the Barren River, to furnish electricity for lighting, heat and power in this city and vicinity. The company is planning to build an electric railway from this place to Elizabethtown.

HENDERSON, KY.—K. R. Battin, superintendent of the Henderson Traction Company, announces that the company will purchase a 250-hp boiler, one 125-kw direct-current generator and engine. During the next two months contracts will be placed for the construction of two miles of extensions.

LEXINGTON, KY.—It is reported that the large central power house of the Lexington & Interurban Railway Company is to be located at Valley View, on the Kentucky River.

PADUCAH, KY.—Plans are being considered for a lighting plant for the court house.

DE RIDDER, LA.—A petition is being circulated asking for an election to vote on issuing bonds for waterworks and an electric light plant.

OPELOUSAS, LA.—P. A. Rutledge has under consideration the purchase of electrical equipment.

MANGUM, ME.—W. T. Funderburk has purchased the electric light plant in this place for $20,000.

BALTIMORE, MD.—The Kent Traction Company, which is planning to construct an electric railway to connect Chestertown and Tolchester, a distance of 11 miles, expects to commence work on the road in the near future. The company will furnish electricity for lighting and power. Alva A. Lamkin is secretary and manager.

FREDERICK, MD.—The Frederick Interurban Railway Company, recently incorporated, will absorb the Frederick & Middletown Electric Railway. Plans are being made by the new company for the erection of a power plant during the coming summer, as the power plant in the Middletown Valley is inadequate to meet the demands made upon it at the present time. The new plant will probably be located in Frederick. Emory L. Coblentz is vice-president of the Frederick & Middletown Electric Railway Company.

RISING SUN, MD.—The contract for lighting the town by electricity has been awarded to the newly organized Electric Light, Heat & Power Company of Rising Sun. The plant will be installed by B. F. Groff, of Lancaster, Pa., and John S. Livers, of Richmond, Va., will have charge of the electrical equipment.

AYER, MASS.—The citizens at a recent town meeting voted to appropriate $2,235 for lighting the streets with electricity, and to authorize the Selectmen to make the necessary contracts.

CHICOPEE, MASS.—The committee of Aldermen appointed to consider the proposed appropriation of $11,500 for the improvement of the electric light department may recommend an appropriation larger than that asked in order that changes may be made which will entirely do away with the use of gas for street lighting. The committee is composed of Aldermen Craig, Corcoran and Storms. The change that is being considered would cost from $18,000 to $19,000 and would make possible the lighting of the entire city by electricity from the plant. The present arc lamps would be replaced by more modern lamps and the entire plant changed to an alternating current. About 150 arc lamps are now used for street lighting. If the change is made about 40 additional lamps will be installed.

DEDHAM, MASS.—At a town meeting held April 1 the citizens voted to appoint committees to consider the advisability of purchasing a controlling interest in the Dedham Water Company and the electric lighting plant.

NEEDHAM, MASS.—At a town meeting held recently the citizens voted to appoint a committee of five consisting of the chairman of the Board of Selectmen, chairman of the Water Commissioners and three citizens to be appointed by the moderator to investigate the advisability of the town acquiring a plant of its own for street and commercial lighting, and authorizing the expenditure of $250 for the employment of experts and for other necessary expenses.

NORTH ABINGTON, MASS.—The Electric Light & Power Company of North Abington and Rockland has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue new stock to the amount of $60,000.

SOUTH HADLEY FALLS, MASS.—The South Hadley Falls Electric Light Company has issued notices to its patrons stating that the minimum fee for an electric light meter will be 50 cents a month, beginning April 1.

BERRIEN SPRINGS, MICH.—Work has commenced on the construction of a large dam for the Berrien Springs Power & Electric Company in this place. More than a year will be required for the completion of the work, which will cost more than $1,000,000. A. B. Ayers, of this place, has charge of the work.

HANCOCK, MICH.—The citizens have decided to issue bonds to the amount of $50,000 for the erection of the proposed lighting plant.

LANSING, MICH.—A notice of the dissolution of the Grand River Electric Company, of Lansing, with a capital stock, has been filed.

LANSING, MICH.—The Board of Electric Light and Water Commissioners of this city has under consideration a proposition from the Michigan Power Company for the lease of the municipal electric lighting plant. The company offers to pay 5 per cent on the investment and 5 per cent depreciation yearly, and has made an offer to furnish lighting cheaper than the city can operate its plant.

MASON, MICH.—The Common Council is considering the abandonment and disposal of the municipal lighting plant now in use, and securing electricity for lighting and power from the Commonwealth Power Company of Jackson. The municipal plant is fast deteriorating in value and utility, and becoming a constant bill of expense to the city for repairs and new equipment. The pumps at the waterworks will also be operated by electricity, if the proposed plan is carried out.

MONROE, MICH.—The capital stock of the Ida Telephone Company has been increased from $5,000 to $10,000.

PONTIAC, MICH.—The city of Pontiac has taken action against the Pontiac Standard Lighting Company to annul the contract with the company for street lighting. The petition asks that the contract be declared null and void, and also the commercial lighting ordinance be declared null and void and the bond of $5,000 be forfeited to the city, and that the company be compelled to remove its poles and wires from the streets.

SAGINAW, MICH.—The Valley Telephone Company has been reorganized. E. T. Carrington, of Bay City, was elected president of the company to serve until the next annual meeting. The other officers remain.

ST. CLAIR, MICH.—The City Council is preparing to improve the light and water plant.

ST. LOUIS, MICH.—The Valley Telephone Company has been reorganized, and E. T. Carrington, of Bay City, has been elected president.

CHISHOLM, MINN.—The electric light plant in this place has been purchased by A. McMillan, of Grand Rapids, Mich. The new owner contemplates improvements to the plant involving an expenditure of $25,000.

EAST GRAND FORKS, MINN.—The Citizens of East Grand Forks on March 27 decided in favor of entering into a contract with the Grand Forks Gas & Electric Company to supply the city with electricity, and not to rebuild the municipal lighting plant at this time. The municipal lighting plant was not a paying enterprise, and many of the citizens are opposed to rebuilding it. The plant was destroyed by fire March 22.

FERGUS FALLS, MINN.—A. Brandenburg, chairman electric light committee, writes that the citizens on April 2 voted to construct a dam for power purposes. The cost is reported to be about $40,000. F. A. Fourtado, of Chicago, Ill., is engineer.

ST. PAUL, MINN.—The creation of a water, light, power and building commission in cities and villages of less than 10,000 inhabitants is provided for in a bill introduced to the Legislature by Senator S. A. Nelson, of Lanesboro. The commission is to consist of three members appointed by the Council for three years. The commission is to have full control over the water, light and power plants owned by municipalities.

BELLEVILLE, MO.—The East St. Louis Gas Light Company and the Belleville Gas & Electric Company have been consolidated under the name of the St. Clair County Gas & Electric Company. The new company will have a capital stock of $3,500,000.

SPRINGFIELD, MO.—T. P. McDonough, of Chicago, Ill., and C. P. McFanny, of Nevada, Mo., representing the capitalists who are building the electric railway from Nevada to Springfield, are considering the proposition to extend the line from Springfield to Carthage.

BARNESTON, NEB.—The Barneston Mutual Telephone Company has increased its capital stock to $7,000.

ROCKAWAY, N. J.—The Rockaway Electric Light & Improvement Company has applied to the Council for 20-year franchise. The company is represented by S. B. Libby.

ALBUQUERQUE, N. M.—The Albuquerque Gas, Electric Light & Power Company has increased its capital stock from $200,000 to $500,000.

BATH, N. Y.—The Village Trustees are advertising for bids for lighting the streets for a term of years beginning September next. The contract existing between the city and the Bath Electric & Gas Company for street lighting will expire the latter part of September. The village now pays $5,000 a year for its street lamps.

FAIRPORT, N. Y.—A new engine is now being installed in the municipal electric lighting plant. An appropriation of $5,000 was made recently for an engine and additional equipment for the plant. F. E. Pritchard is superintendent.

FORT WOOD, N. Y.—Bids will be received by G. C. Burnell, Constructing Quartermaster, U. S. A., until June 1 for furnishing and installing electric light fixtures, etc., in certain buildings at this post.

GOUVERNEUR, N. Y.—A franchise has been granted by the Village Board of Trustees to the Northern Light & Power Company, of Potsdam. The franchise as granted calls for the completion of the power line to this place from Hannawa Falls within a year from the date of the agreement and at least 500 horse power must be delivered at that time.

LITTLE FALLS, N. Y.—Surveying corps are now located at Inghams Mills, making preliminary plans for a power plant to be located there for the East Creek Electric Light & Power Company. Guy R. Beardsley, of East Creek, is interested in the company.

LOWVILLE, N. Y.—At a special election held April 2 the citizens voted to purchase the electric plant and system of the Wetmore Electric Company to be operated by the municipality. The price to be paid for the plant is not to exceed $85,000.

NEW BRIGHTON, N. Y.—The Richmond Light & Railroad Company has recently placed orders for a 1500-kw alternating-current steam turbine and a 500-kw rotary converter.

NEW PALTZ, N. Y.—The Poughkeepsie Light, Heat & Power Company is extending its lines to New Paltz, and has asked for a franchise to enter the village.

SALAMANCA, N. Y.—The Western New York & Pennsylvania Traction Company has applied to the Village Trustees for a right of way over certain streets in the village to operate its lines in connection with the proposed extension from Salamanca to Little Valley. The company has also applied to the Village Board of West Salamanca for a franchise for the use of the streets in that village.

WHITEHALL, N. Y.—The Whitehall & Granville Railroad Company has been granted permission by the State Board of Railroad Commissioners to increase its capital stock from $400,000 to $790,000 and to issue a mortgage for $700,000. A former mortgage of $400,000 is to be cancelled.

CHARLOTTE, N. C.—The Charlotte Pipe & Foundry Company is contemplating the purchase of electric motors.

CHARLOTTE, N. C.—R. L. Wiede, a civil engineer of Washington, D. C., is making plans for a large hydro-electric plant near Linville which will be developed at a cost of $1,500,000.

FAYETTEVILLE, N. C.—The dam of the Electric Bond & Share Company, of New York, on the Cape Fear River, at Buckhorn Falls, near Fayetteville, N. C., will have to be rebuilt on account of a defect in the original construction, causing a loss of about $50,000. About $100,000 worth of electrical machinery, ordered some months ago, is declared to be practically ruined by exposure. It is said that the plant will be in partial operation by June 1, if the new machinery arrives on time.

MONROE, N. C.—Frank Armfield, J. A. Bivens, and others have been appointed a committee to confer with the Southern Power Company, of Charlotte, N. C., relative to bringing electricity to the town. The power company asks that 1000 horsepower shall be contracted for, to warrant it in building transmission lines, etc.

WASHINGTON, N. C.—The Washington Investment Company has secured a charter to build a four mile electric railway system in this town.

GALION, OHIO.—A franchise has been granted by the City Council to the Galion Southern Electric Railway, which completes the entire distance from Galion to Mt. Vernon, a distance of 35 miles. Negotiations are now being made with Eastern capitalists for the immediate construction of the road.

MARION, OHIO.—The Marion County Telephone Company has purchased the plant of the Central Union Telephone Company here, as well as at Waldo, Morral, Wyandot and Kirkpatrick, and retains its plant at Green Camp. The Central Union, in the trade, gets the exchanges at Caledonia, Agosta and La Rue. All these exchanges will use the Bell long distance lines. This, it would seem, means a combination that takes the exchanges named out of the independent field and allies them with the Bell interests.

MIDDLEFIELD, OHIO.—The town lighting plant, operated by the Ohio Pail Company, was destroyed by fire recently.

WEST MILTON, OHIO.—Bids and propositions are wanted for lighting the town of Milton (P. O. West Milton) with electricity. Population, 12,000 to 15,000. Address, John Coote, corporation clerk.

ALLENTOWN, PA.—The new power house of the Lehigh Valley Traction Company is nearly completed and when put in operation will furnish electricity for operating the line from Allentown to the Philadelphia border at Wheel Pump. The company is now building a series of sub-stations along the route and will discard the power plants along the line at Ambler, Souderton and other places. The sub-stations are to be erected at Ambler, Lansdale, Souderton and other points along the line.

ALLENTOWN, PA.—The City Council has passed an ordinance granting the Lehigh Valley Traction Company a franchise to construct and operate a belt line and certain extensions of its lines in this city for which the company is to pay the city $15,000 to be used toward the cost of the Tilghman Street bridge.

DUQUESNE, PA.—The question of constructing a municipal electric light plant is being discussed here.

HARRISBURG, PA.—Senator Brown, of Philadelphia, has introduced a bill in the State Legislature permitting street railway companies or any motor company to enter into contracts for the sale of electric energy to motor, truck, express or parcel carrying companies. The object of the bill is to enable the Philadelphia Rapid Transit Company to enter into a contract with a company which is being organized to run auto express wagons on its tracks.

JOHNSTOWN, PA.—The Dale Light, Heat & Power Company will renew its efforts to secure a franchise in this city. The company is contemplating doubling the present capacity of its plant. New boilers, engines and other machinery will be installed. George E. Daniels is president of the company.

MONONGAHELA, PA.—R. W. Hervey, secretary of the Danora & Eldora Street Railway Company, writes that work on the construction of the proposed road will commence about May 1. The company will ask for an increase in capital stock from $24,000 to $125,000. The road when completed will connect Danora and Eldora, a distance of three miles.

PHILADELPHIA, PA.—Mayor Weaver in his message to the Councils April 1 recommends that the ordinance granting a franchise to the Commonwealth Electric Company be passed as a means of promoting competition which will cheapen the city's light supply.

SOUTH SHARON, PA.—The citizens have voted to construct a municipal lighting plant.

PROVIDENCE, R. I.—Marsden J. Perry, president and general manager of the Narragansett Electric Lighting Company, has announced a reduction in the gross price of electricity, which will go into effect at the May readings of the meters. The price is reduced from 20 cents per kw-hour to 14 cents. This is the new gross rate at which electricity for all purposes will be furnished in amounts where the monthly consumption aggregates less than $25 in value. Upon bills of $25 and over, a

graduated scale of discounts will be applied, the rate of discount varying with the uses to which the current is put by the consumers and the amount consumed. Under the new schedule of rates the 20 per cent reduction on incandescent lighting bills will be abolished on all bills under $25. The new flat rate of 14 cents per kw-hour will be charged instead of 16 cents net, so that the small consumers of electricity for incandescent lighting will realize an actual gain of 2 cents per kw-hour, or 12½ per cent. Users of electricity for purposes other than incandescent lighting, such as for arc lighting, power, etc., who consume large quantities each month, will realize a greater reduction in the cost of electric energy. The new rate does not affect the cost of municipal electric lighting to the city, which is under a contract entered into several months ago.

NEWBERRY, S. C.—Application has been made to the City Council by H. L. Parr, of the Parr Shoal Power Company, for a franchise to operate an electric street railway in this city.

DEADWOOD, S. D.—The Homestake South Extension Company will discard its steam plant and will install electricity for operating its mines.

KNOXVILLE, TENN.—Col. T. B. Burridge, of Denver, Colo., with two associates, are interested in the proposition to build a dam and power plant on the Little Tennessee River to supply power for Knoxville. The proposition is an old one enlarged. Instead of building a $2,000,000 plant, they now propose to build a $3,500,000 plant. Col. Burridge recently became interested in the Knoxville Power Company and came here to personally inspect properties the company had acquired.

NASHVILLE, TENN.—A charter has been granted by the Secretary of State to the Home Telephone Company, of Nashville, with a capital stock of $1,000,000. The incorporators are W. C. Polk and others.

TRENTON, TENN.—An election will probably soon be held to vote on issuing $12,000 in bonds for an electric light plant. W. L. Wade is Mayor.

BELLEVILLE, TEX.—The construction of an electric light plant in this city is now under consideration.

BRAZOS, TEX.—The Brazos Oil & Light Company has increased its capital stock from $150,000 to $300,000.

ELGIN, TEX.—W. H. Rivers has secured a franchise for waterworks and an electric light plant.

McKINNEY, TEX.—The McKinney Telephone Company has filed an amendment to its charter increasing its capital stock from $30,000 to $40,000.

WORTHAM, TEX.—A. M. Pittman has secured a franchise for an electric light plant.

SALT LAKE CITY, UTAH.—The Shoshone Power Company, Ltd., has filed with the State Engineer an application for 400 second-feet of water in Utah Lake and Jordan River in Utah County. The diverting works will consist of dam, head gate and a canal and pipe line. The water applied for is to be used to generate electricity for lighting and power purposes in Utah, Juab and Salt Lake counties.

CAVENDISH, VT.—L. N. Wheelock, of Claremont, N. H., manager of the power plant contemplated at Cavendish, writes that W. A. Brackenridge, of Niagara Falls, N. Y., is engineer of the proposed work.

BRISTOL, VA.—The town of Bristol is interested in the development of a hydro-electric plant on the Holston River. Prof. C. E. Farris, of the University of Tennessee, has been employed to make estimates. The Bristol Board of Trade is backing the movement.

CHARLOTTE, VA.—The City Council has granted a franchise to the promoters of the Albion-Charlotte Interurban line.

NEWPORT NEWS, VA.—The Newport News & Old Point Railway & Electric Company is contemplating an expenditure of $250,000 for improvements to its system. W. S. Butler is manager.

OLYMPIA, WASH.—The Nisqually Power Company has filed with the county auditor plans for the construction of a power plant in Thurston County on the Nisqually River.

TACOMA, WASH.—Application for a charter has been made by the Hannaford Valley Railway Company to build a direct line from Tacoma to Centralia, for which a preliminary survey has been made. E. B. Cox is president of the company.

MOUNDSVILLE. W. VA.—The Moundsville Electric Light Company has recently established a day service.

FOND DU LAC, WIS.—The Eastern Wisconsin Railway & Light Company is considering the erection of a combined power house and gas plant. W. J. Kelsh is superintendent.

GRAND RAPIDS, WIS.—At a recent election the citizens voted to purchase the electric lighting plant. At present the plant is being run on the co-operative plan.

HATFIELD, WIS.—The J. G. White Company, of New York, N. Y., is the engineer and will supervise the construction of a dam across Black River at Hatfield for the La Cross Water Power Company.

LA CROSSE, WIS.—The La Crosse Gas & Electric Company and the Wisconsin Light & Power Company have been consolidated.

MILWAUKEE, WIS.—Charles J. Poelsch, city engineer, writes that bids will probably be called for in about three weeks, for constructing a gas producer plant for the municipal electric light plant at a probable cost of $300,000. H. S. Bowen, of Milwaukee, is the engineer.

MILWAUKEE, WIS.—Extensive improvements are contemplated by the Milwaukee Electric Railway & Light Company, work on which will begin as soon as the necessary authority is received from the municipality or the courts. A new power house having a capacity of 100,000 kw will be erected.

OCONOMOWOC, WIS.—The Badger Telephone Company has increased its capital stock from $5,000 to $25,000.

PRAIRIE DU SAC, WIS.—J. S. Tripp of Prairie du Sac; Robert Buer, of Sauk City, Ia.; M. A. Devitt, of Chicago, Ill., and Magnus Swenson, of Madison, are interested in the construction of a dam across Wisconsin River for power purposes to cost about $1,500,000. A charter has not yet been obtained.

WOODHULL, WIS.—Arrangements have been made for the organization of the Woodhull Telephone Company to provide service to the residents of Fond du Lac and Larartime. The company will be capitalized at $2,500. Otto Fenner is interested.

FERNIE, B. C.—The Crows Nest Electric Light & Power Company is arranging for the construction of telephone lines to Hosmer and Elkmouth.

CALGARY, CAN.—The City Council has voted to appropriate $250,000 for an electric street railway system which will be built this summer. Tenders for construction and the necessary materials will be called for at an early date. Address City Engineer Thorold.

WINNIPEG, MAN.—The Manitoba Radial Railway Company has been incorporated for the purpose of constructing electric railways around Winnipeg and adjoining towns.

FORT WILLIAM, ONT.—Plans are being prepared for the construction of a power plant in this place.

SAULT STE. MARIE, ONT.—The Tagona Water & Light Company of the Canadian Soo has placed an order with the Canadian Westinghouse Electric Company for four new machines for its plant, consisting of three three-phase alternators and a rotary converter.

TORONTO, ONT.—The Toronto Electric Light Company is said to contemplate abolishing charges for meters for lighting and reducing the price of electricity for lighting purposes by 15 or 20 per cent. The charge for meters is 25 cents a month. The light rates vary from 8 to 12 per kw-hour for house and business use respectively.

SALTILLO, MEX.—At a recent meeting of the stockholders of the Saltillo Electric Light & Power Plant, the company decided to increase its capital to $200,000. Extensive improvements are contemplated.

## Company Elections.

MANKATO, MINN.—At the annual meeting of the Mankato Citizens' Telephone Company held April 1, the following officers were elected for the ensuing year: H. A. Patterson, president; N. Petersen, vice-president; D. W. Willard, secretary and treasurer.

WEST UNITY, OHIO.—Officers have been elected by the directors of the local electric light company, as follows: A. M. Miller, president; J. A. Hollington, vice-president; L. G. Ely, secretary-treasurer.

MEDICINE HAT, CAN.—At the annual meting of the Alberta Southeastern Telephone Company the following officers were elected: John Huston, president; S. T. Fawcett, vice-president; directors, F. L. Crawford, W. C. Harris, W. Rutherford, G. H. Smibert and J. H. Spencer.

## New Industrial Companies.

THE AMERICAN CARBON COMPANY, of Jersey City, N. J., has been incorporated, with a capital stock of $300,000, for the purpose of manufacturing carbon. The incorporators are: William P. Catlin, George W. Romaine and Joseph Mackey.

THE AMERICAN MACHINE & MANUFACTURING COMPANY, of Charlotte, N. C., has been chartered, with a capital stock of $300,000, to furnish and manufacture electric, hydraulic and steel power transmission machinery, D. A. Tompkins, S. B. Sargent and J. W. Conway are the stockholders. The new company will succeed in a large measure the D. A. Tompkins Company, of Charlotte.

THE BUREAU OF ILLUMINATING ENGINEERING, of New York, N. Y., has been incorporated, with a capital stock of $20,000. The directors are: A. A. Ernst, W. S. Kilmer and J. B. Siberman.

THE FALKENAU ELECTRICAL CONSTRUCTION COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $5,000. The purpose of the company is the construction and equipment of utility plants. The incorporators are: Victor Falkenau, E. A. Burrows and H. A. Strauss.

THE FARIBAULT MANUFACTURING COMPANY, of Faribault, Minn., has been incorporated by F. R. Runner and others to manufacture gasoline engines and dynamos. The company is capitalized at $50,000.

THE SOUTHERN ELECTRIC CONSTRUCTION COMPANY, of South Bend, Ind., has been incorporated, with a capital stock of $100,000, by T. Denoon, of Chicago, Ill.; H. John Noel, of South Bend, Ind.; W. H. Clinton, of Indianapolis, and others.

THE TWIN CITY ELECTRIC & CONSTRUCTION COMPANY, of Winston-Salem, N. C., has been incorporated to handle and deal in electrical supplies and to do electrical construction work. The capital stock is $25,000 and the incorporators are: E. G. Couch, S. L. Blackburn and A. H. Galloway.

THE WESTERN ELECTRIC SUPPLY COMPANY, of El Paso, Tex., has been incorporated with a capital stock of $100,000 by W. B. Carroll, J. M. Power, S. A. Milliron and Max Weber.

THE WITHERBEE MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $100,000, for the purpose of manufacturing storage batteries. The directors are: T. S. Witherbee, H. H. Cooley and J. H. Hendrick.

## New Incorporations.

SACRAMENTO, CAL.—Articles of incorporation have been filed for the Western Sierras Power Company for the purpose of locating and dealing in water rights for power purposes and distributing electricity for lighting and power purposes. The directors are: C. C. Bonto, H. Stillman and E. S. Brown.

SAN JOSE, CAL.—Articles of incorporation have been filed for the San José Traction Company, with a capital stock of $1,000,000. The incorporators are: John Martin, S. S. Baldwin, C. C. Benson and E. M. Rea. The road will be six miles long.

CRAIG, COLO.—The Craig Mutual Telephone Company has been incorporated, with a capital stock of $10,000, by U. F. Harrison and others.

DENVER, COLO.—The Brush Electric Light & Fuel Company has been chartered, with a capital stock of $20,000, by William E. Green and others.

TAMPA, FLA.—Articles of incorporation have been filed for the Tampa & West Coast Railway Company by J. N. Holmes, C. B. Ware and J. Craig Phillips. The company is capitalized at $300,000 and proposes to construct an electric railway from Tampa to Clearwater, and thence to Petersburg, a distance of about 40 miles.

CARTHAGE, ILL.—The Mississippi Valley Electric Railway Company has been chartered for the purpose of building an electric railway between Carthage and Nauvo, connecting with Keokuk and Fort Madison, Ia., a distance of 65 miles. The temporary offices of the company are with the Fidelity Insurance Company, Chicago.

CHATHAM, ILL.—The Union Telephone Company has been incorporated, with a capital stock of $35,000, by Fred W. Kelly, F. A. Bowdle and C. B. Cheadle.

EAST ST. LOUIS, ILL.—Articles of incorporation have been filed for the East St. Louis & Southeastern Railroad Company by L. C. Haynes, T. W. Gregory, G. C. Pierce, James A. Farmer and Fred H. Kruger. The company is capitalized at $2,500.

GRANTFORK, ILL.—The Grantfork Mutual Telephone Company has been incorporated, with a capital stock of $2,400, by Julius Reinhart and others.

LINCOLN, ILL.—The Lincoln Railway & Light Company has been incorporated, with a capital stock of $2,500, by M. O. Payne and others.

NASHVILLE, ILL.—Articles of incorporation have been filed for the Washington County Telephone Company by Isaac Reidelberger and others. The capital stock of the company is $2,400.

SUMMERFIELD, ILL.—Articles of incorporation have been filed for the North Grove Telephone Association. The capital stock is $2,500 and the incorporators are: George Leutinger, Samuel Baer and John Hirnstein.

DANVILLE, IND.—The Danville Light, Heat & Power Company has been incorporated, with a capital stock of $36,000. James F. Lynch, G. E. Varney and R. P. Van Camp are the directors.

HAMMOND, IND.—The Chicago, Hammond & Gary Electric Railroad Company has filed articles of incorporation, with a capital stock of $100,000. The incorporators are: H. L. Underwood, L. C. James, and F. A. Carstensen, of Chicago, Ill., and A. V. Barton, of Elgin, Ill.

INDIANAPOLIS, IND.—The Big Spring Telephone Company, of Boone County, has been incorporated with a capital stock of $10,000, by Addison Higbee and others.

DAVENPORT, IA.—The Independent Light & Power Company has been incorporated with a capital stock of $600,000.

AMITE CITY, LA.—The Central Light & Power Company, of this place, has been incorporated with a capital stock of $10,000.

GREENFIELD, MASS.—A provisional company to be known as the Greenfield, Bernardston & Northfield Street Railway Company has been formed for the purpose of taking preliminary steps towards the construction of an electric railway from Greenfield to Northfield. The company is capitalized at $75,000, and the directors are: John Wilson, Lester A. Luey and Archibald D. Flower, of Greenfield; John W. Chapin and Everett E. Benjamin, of Bernardston, and Charles H. Webster, of Northfield.

HOLDEN, MO.—Articles of incorporation have been filed for the Citizens' Mutual Telephone Company, with a capital stock of $2,500, by M. C. Bell and others.

KANSAS CITY, MO.—A charter has been granted to the Wyandotte & Lawrence Railroad Company, with a capital stock of $510,000, for the purpose of constructing a railway between Lawrence and Kansas City to be operated by electricity, steam or gasoline. The road will be 38 miles in length. The directors are: Benjamin Schnierle, J. E. Wetherell, F. K. Schuepbach, H. C. Downs and E. Y. Blum.

ANDES, N. Y.—The Gladstone Hollow Telephone Company has been incorporated by Elliott Graham, Reed Dumont and H. W. Frisbee, of Andes.

SYRACUSE, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Syracuse & South Bay Electric Railroad Company. The capital stock is $1,500,000 and the directors are A. K. Hiscock, William Nottingham and C. A. Lux, of Syracuse.

SYRACUSE, N. Y.—Articles have been filed with the Secretary of State for the incorporation of the Syracuse & Milford Railway Company, to run from Syracuse to Milford, a distance of 12 miles.

TROY, N. Y.—Articles of incorporation have been filed for the Trojan Railway Company with a capital stock of $200,000. The directors are J. A. Powers, J. T. Dennin, of Troy, and Thomas O'Connor, of Waterford.

BEAUFORT, N. C.—The Old North State Telephone Company has been chartered with a capital stock of $125,000. The incorporators are D. P. Bible, J. W. Boon and Forrest W. Bible.

## Legal.

WIRES IN CONDUITS.—The Supreme Court of Ohio has handed down a decision to the effect that a telephone company has a right to place its wires in conduits without the consent of abutting property owners on the street, if it holds a franchise from the City Council. The case came from the Circuit Court of Franklin County, and dissolves a perpetual injunction granted to Daniel Sullivan against the Citizens' Telephone Company of Columbus. Judge Evans granted Sullivan a temporary injunction to prevent the company placing its wires in conduits in front of his property on North High Street. Later he made it permanent. The case was carried up by the company.

RIGHT OF LINEMAN TO RELY UPON FOREMAN TO NOTIFY HIM OF DANGER WHILE AT WORK.—The rule that it is the duty of a foreman to warn those under his supervision of impending danger is applied in a recent Massacusetts decision. A lineman in the employ of a telegraph company was instructed by his foreman to ascend one of the company's poles for the purpose of placing a wire in position. The pole was located between two sets of railroad tracks belonging to the defendant railroad company, and leaned slightly toward one of the tracks. The lineman, carrying a handline, started to climb the pole and while doing so was struck by a car belonging to the defendant and injured. It appeared that the plaintiff saw the car by which he was struck approaching in the distance, but paid no attention to it after starting up the pole. In an action against the defendant for damages it was urged as a defense that the plaintiff was not in the exercise of due care inasmuch as the evidence showed that with full knowledge that a car was approaching he went up the side of the pole near the track upon which the car was coming, and took no precaution whatever to protect himself from injury. The plaintiff contended that he relied upon his foreman to warn him if the car should come dangerously near, and that he had a right to thus rely upon him. It was held that, in view of the fact that the plaintiff was heavily encumbered and that close attention was necessary to properly execute the work which he was expected to do, it was reasonably necessary that some one should be on the ground for the purpose of warning him of danger and that the defendant was liable in damages. It was immaterial that the foreman upon whom the duty of giving warning rested was not connected with the defendant company in any way. Ahearn vs. Boston Elevated Railroad Company, Supreme Judicial Court of Massachusetts, 80 N. E. Rep. 217.

ELECTRICAL COMPANY NOT RESPONSIBLE IN DAMAGES WHERE PERSON INJURED IS GUILTY OF CONTRIBUTORY NEGLIGENCE.—The rule that damages are not recoverable where one is injured or killed after having placed himself deliberately and knowingly in danger is involved in a recently decided Kentucky case, in which the facts are substantially as follows: One Westcott was in the employ of a railroad company in the capacity of night gate operator in the watchtower at one of the railroad crossings. In the watchtower there was what is known as a "Block signal telephone box," which connected with a private telephone line, owned and operated by the Citizens' Telephone Company. The telephone line had sagged down until it rested upon the highly charged wire of the Union Light, Heat & Power Company and by the contact became dangerously charged with electricity which was conveyed to the telephone box in the watchtower. It there burned out the fuse and manifested itself by a buzzing sound and emitting sparks. This unusual condition attracted Westcott's attention, who remarked to a fellow employee that "the thing had a fit" and immediately began a series of experiments by placing his finger lightly against the box and withdrawing it quickly thereby causing sparks to fly. He also obtained a short piece of insulated wire, and, holding it by the insulated part, he placed the uninsulated ends to the box, making it emit a shower of sparks. The experiments continued at intervals for a number of hours until finally Westcott placed his hand in such position as to receive a shock which caused him to involutarily grip the box and he was hurled to the floor by the force of the current and almost instantly killed. An action at law was instituted by Westcott's administratrix against the telephone company and the power company and a verdict of $15,000 was rendered against the telephone company, the power company being held free from liability. The telephone company appealed and obtained a reversal of the judgment against it on the ground that Westcott was killed while wantonly experimenting with a known danger and that his own negligence contributed to the cause of his death. Citizens' Telegraph Company vs. Westcott's Administratrix, Court of Appeals of Kentucky, 90 S. W. Rep. 1153.

BUCKET SHOPS.—The Supreme Court has affirmed the decision of the Federal Court in issuing an injunction restraining the telegraph companies from delivering to Hunt, the owner of an alleged bucket shop in Memphis.

LIABILITY OF MUNICIPAL CORPORATION FOR NEGLIGENT OPERATION OF ITS ELECTRIC LIGHTING PLANT.—In an action against the village of Palestine, Ill., to recover damages for the death of a person resulting from contact with one of the defendant's electric wires it was shown that the village owned and operated an electric lighting plant. At a crossroads, where a light was maintained, the lamp was suspended in the center of the intersection of the roads from two poles located on diagonally opposite corners. An insulated wire running from the electric light plant was attached to pins, furnished with glass insulators, fastened on cross-arms near the tops of the poles. From a point about a foot below the cross-arms on one of the poles an insulated guy wire was extended across the sidewalk to a shorter pole placed outside of the street line. Prior to the accident the pin holding one of the electric light wires to the arm of the pole broke off, and let the wire with the insulator drop down and rest upon the guy wire. The insulation on the wires had become worn and was defective, permitting the electric current to be communicated to the guy wire. The deceased, a boy of 18 years, while on his way home from the store where he worked came in contact with the guy wire in some manner and was killed. It was held that the administrator of the deceased was entitled to an award of damages against the village under section 62, chapter 24, Hurd's Revised Statutes 1905, imposing the duty upon municipal authorities to regulate the use of streets and "prevent and remove encroachments or obstructions upon the same." It made no difference that the defendant maintained the plant in its public municipal capacity. For, under the statute, whoever owned the plant, whether a municipal corporation, a private corporation, or an individual, the village was bound to see that its streets were not improperly used or rendered dangerous to persons properly using them. Village of Palestine vs. Siler, Supreme Court of Illinois, 80 N. E. Rep. 345.

## Personal.

MR. A. C. REED, of Kenora, Ont., has been appointed superintendent of the electric light and power plant in Moosejaw, Sask.

DR. CLAYTON H. SHARP delivered a lecture April 11 on "Recent Developments in Electric Lighting" before the Brooklyn Institute of Arts and Sciences.

MR. L. B. MARKS delivered a lecture March 10 before the Stevens' Engineering Society of Stevens' Institute on the subject of "Engineering Illumination."

MR. FRANK L. FULLER, general manager of the New York & Queens County Railroad, has been elected president of the company to succeed Arthur Turnbull, resigned.

MR. FRED. W. NASON, 39 Cortlandt Street, New York City, has accepted the New York agency for the Keystone Electrical Instrument Company for its full line of electrical measuring instruments, etc.

MR. GEORGE B. WOODBRIDGE, treasurer and manager of the Home Telephone Company of San Diego, Cal., has resigned to accept a position with the Puget Sound Construction Company, of Tacoma, Wash.

MR. GARDNER CORNETT, of Providence, R. I., has recently been elected vice-president of the American Steam Gauge & Valve Manufacturing Company, his office being located at the headquarters of the company, 220 Camden Street, Boston.

MR. C. W. WHITNEY is the writer of an article in the current issue of *The Michigan Technic* on the Doble tangential water wheel in the engineering laboratory of the University of Michigan. Mr. Whitney is an alumnus of this university, class of '99.

MR. PETER J. LYNCH, division manager of the Pacific States Telephone & Telegraph Company, with headquarters in Oakland, Cal., has been promoted to the position of assistant general superintendent, with offices in San Francisco, Cal. He has been succeeded in Oakland by John Kearns.

MR. FREDERICK S. MILLS has been appointed general superintendent of the Monterey County Gas & Electric Company, of Monterey, Cal., and Frederic Southerland has been made assistant superintendent of the same company. Mr. Mills has been a salesman with the General Electric Company, and Mr. Southerland was formerly connected with the New York Edison Company in New York City.

MR. C. E. MARSH, manager of the Saginaw exchange of the Valley Telephone Company, Michigan, has gone West to accept the position of general manager of a company which owns an extensive local and long distance telephone system, an electric lighting and gas plant and other public utility concerns with headquarters at Garden City, Kan., and of which his brother, Frank Marsh, is the principal owner. In his new position Mr. Marsh secures a much larger salary, with opportunity for rapid advancement.

MR. F. P. THOMPSON.—At a special meeting of the directors of the New Brunswick Telephone Company, Canada, held at Fredericton, N. B., Senator Thompson, who has filled the position of managing director for many years, was elected president, in succession to the late Dr. A. A. Stockton, M. P., deceased. Alfred Seely was appointed secretary-treasurer in room of W. E. Smith, resigned, and Frank B. Carvell, M. P. for Woodstock, was chosen to fill the vacancy in the board of directors. Senator Thompson will continue to act as managing director.

MR. E. H. WISE, general manager of the Dale Light, Heat & Power Company, Johnstown, Pa., on April 1 assumed the management of the Citizens' Light, Heat & Power Company, of Altoona, Pa. Mr. Wise has been engaged in the electrical business 23 years, having started out in the employ of the Cambria Steel Company, and is a man of recognized executive ability.

MR. R. E. DANFORTH, vice-president and general manager of the Rochester Railway Company, of Rochester, N. Y., has been appointed general manager of the Public Service Corporation to succeed Mr. Albert H. Stanley, who has gone to England, to assume the management of the Underground United Railway Company, Ltd., of London. Mr. Danforth has been identified with traction interests since 1891, when he graduated from Cornell University. His first work was in the mechanical department of one of the constituents of what is now the International Traction Company. He continued with this company until 1901, serving for part of the time during this connection as superintendent of the system. In 1901 he was appointed to the position of general manager of the Lake Shore Electric Railway Company. Mr. Danforth expects to assume his new duties May 1.

MR. C. H. HILL.—The Northampton (Mass.) *Gazette* of recent date had the following item: "Charles H. Hill, who has been chief engineer of the Northampton electric light station for a number of years, has closed his services, having accepted the position of assistant superintendent of the Poughkeepsie, N. Y., Electric Company. He has been succeeded by Frank A. Gorrow, of Chicopee. Just as he was about to leave the office at the electric light works, Thursday night, he was given a complete surprise by the employees of the company who presented him with a beautiful watch fob as a mark of the esteem and respect in which he is held by them. The presentation was made by Theophile Lucier, the assistant engineer of the company, who has been with the company a long time. Mr. Hill responded with appropriate remarks and presented each member of the station with a fine panel photograph of himself."

## Obituary.

MR. H. W. GOODE, president of the Portland, Ore., Railway, Light & Power Company, was stricken with pneumonia while on an eastern trip and died at Atlantic City, N. J., on March 31. He was born at Indianapolis, September 26, 1862. He was a direct descendant of the Goodes of early Virginia. After being educated in the public and high schools of Indianapolis, he studied electricity, and from 1885 to 1892 he was connected with the Westinghouse Electrical Manufacturing Company, of Pittsburg. His rise was rapid. He became general manager of the Portland General Electric Company in 1892 and its president in 1902; and president of the Portland Railway, Light & Power Company in 1906. He was made director general of the Lewis & Clark Fair in 1903 and its president in 1904. He was married in 1889 to Edith B. Fairclough, of Chicago. Two children were born to them. Mr. Goode was a member of the Arlington Club, the Commercial Club and was also a 32d degree Mason and an Elk.

## Trade Publications.

TRANSPORTABLE BATTERIES.—A valuable pamphlet containing instructions for the installation and operation of transportable batteries has been issued by the General Storage Battery Company, 42 Broadway, New York.

AIR COMPRESSORS.—Bulletin No. 374 of the National Brake & Electric Company, Milwaukee, Wis., gives a well prepared illustrated description of portable and stationary motor-driven air compressors for continuous and intermittent service.

KNIFE SWITCHES AND FUSES.—The 1907 catalogue of the Worcester Electric Manufacturing Company, 42 Lagrange Street, Worcester, Mass., gives a complete price list with illustrations of knife switches, fuses, fuse blocks and switchboards.

## Business Notes.

AMERICAN BALL.—The firm of Hunt, Mirk & Co., of San Francisco, has taken the agency for the American Ball engine and electrical machinery.

THE ATLANTIC CITY LIGHT & EQUIPMENT COMPANY has opened at office at room 408 Bartlett Building, Atlantic City, N. J. The company is about to be incorporated, and is placing on the market a new kind of incandescent globe and shade. The company is capitalized at $100,000. H. W. Castor & Company are the fiscal agents of the company.

THE GILLETTE, VIBBER & COMPANY, of New London, Conn., have sold the stocks and good will of their electrical supply and contracting business in which they have been engaged here for several years to the New England Engineering Company. In the future they will devote themselves to the manufacture of electrical devices of their own patent.

THE BANNING COMPANY, of 1 Madison Avenue, New York City, has just issued the following notice: "On and after April 1, 1907,

this organization, heretofore known as Bruce & Banning, will be known as The Banning Company. Our policies and methods of operation will remain as in the past. Our form of organization has been changed only for the purpose of conducting our growing business to better advantage and of extending the scope of the advertising and publicity interests of our clients. The Banning Company is incorporated under the laws of the State of New York with the following directors: Kendall Banning, E. C. De Villaverde, W. H. Denney and Walter Mueller. Mr. E. C. De Villaverde, for the past twelve years business manager of the *Scientific American* and of *American Homes and Gardens*, brings to our organization a wide experience in the conduct of publicity campaigns and a long and successful record in the practical work of advertising. He is now associated with Mr. Banning in the direction of the publicity campaigns conducted by this company. Mr. W. H. Denney, for the past five years general manager of our printing and cost department, will continue to serve in that capacity. Mr. Walter Mueller, formerly editor of the *Electrical Age*, and associate editor of *Cassier's Magazine*, will remain as the head of our editorial department. On May 1 we shall move from our present offices to the Brunswick Building, 225 Fifth Avenue, New York, where we have secured larger quarters that will accommodate our growth."

# Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 2, 1907.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 41 Park Row, N.Y.]

848,636. FIRE AND POLICE SIGNALING SYSTEM; William Condon, Kansas City, Mo. App. filed July 7, 1902. A signal system by which a station on an outlying circuit may communicate telephonically or by automatic signals with either or both of two receiving stations, such as the police and fire departments of a city.

848,658. PLAYING MECHANISM FOR STRINGED INSTRUMENTS; Louis A. Kampelman, St. Louis, Mo. App. filed March 9, 1906. An electromagnet has a pair of curved pole pieces between which an armature is pivoted and which carries the usual hammer of the stringed instrument so as to swing the same downward against the wire.

848,675. WAVE-METER; Joseph Murgas, Wilkes-Barre, Pa. App. filed Jan. 29, 1906. Means for measuring the length of the waves in electric oscillation systems, such as wireless telegraph systems. Also provides for measuring the frequency. Has an electrostatic telephone receiver of adjustable capacity, the capacity being indicated by a micrometer device.

848,676. ELECTRIC TRANSFORMER; Joseph Murgas, Wilkes-Barre, Pa. App. filed March 17, 1906. Transformer for experimental purposes having primary and secondary coils which can be telescoped inside of one another and having brushes by which a greater or less number of coils may be included.

848,701. GAME APPARATUS; Thomas M. St. John, New York, N. Y. App. filed Dec. 3, 1904. Has a vulcanite sheet which is electrified by being rubbed with flannel. This causes special movements of pith balls which fall on squares having predetermined values.

848,719. ALTERNATING CURRENT MOTOR; Edward Bretch, St. Louis, Mo. App. filed Nov. 17, 1905. Aims to provide a machine in which the armature is of very simple construction and which can be started under load without the use of complicated mechanism and with a minimum starting current. Has a squirrel-cage winding embedded in the core within the zone of a commutated winding and separated therefrom by a pathway so that the flux can pass through the commutated winding without penetrating the squirrel cage.

848,720. AUTOMATIC CURRENT INTERRUPTER; Victor H. Broc, New York, N. Y. App. filed Sept. 5, 1906. Provides a high frequency make and break in a battery circuit. Has a vibrating arm or lever composed of two parts hung together by opposing strings. Is designed to overcome "freezing" of the vibrator to the contacts.

848,725. FIRE ALARM APPARATUS; Wellington S. Clay and Albion T. McKenney, Hutchinson, Minn. App. filed Feb. 19, 1904. A device for sending fire alarms and similar purposes. Provides a device of this character in association with an ordinary telephone system whereby an alarm of fire may be sounded when desired on a gong or bell located at a convenient or prominent point.

848,730. SYSTEM FOR TRANSMITTING ELECTRIC CURRENTS TO CARS; John J. Eagan, San Francisco, Calif. App. filed Dec. 26, 1905. Instead of a trolley wire extending longitudinal of the track and engaged by a wheel on the car, patentee has spaced contactors transversely stretched across the street and which are engaged by a long shoe or conductor on the roof of the car with rounded extremities deflected downwardly so as to engage the transverse conductors easily.

848,749. TRUNK-CIRCUIT FOR TELEPHONE SYSTEMS; Joseph B. Kelley and Edwin B. Heaford, Omaha, Neb. App. filed Dec. 31, 1906. In a telephone system, the combination of an exchange station and a toll station, with a two-conductor trunk line, a signal-circuit associated with the trunk line, a bridged relay for closing the signal-circuit when the exchange station is connected with the trunk line, and a means for locking out the signal as long as the bridged relay is energized.

848,750. ELECTRIC TRANSMISSION OF INTELLIGENCE; Isidor Kitsee, Philadelphia, Pa. App. filed June 28, 1906. A form of telegraph system designed to neutralize or counteract the inductive effect of the currents in the co-operating lines. Has specially constructed differentially wound relays with condensers in one branch of a divided circuit through the respective windings.

848,751. ELECTRIC TRANSMISSION OF INTELLIGENCE; Isidor Kitsee, Philadelphia, Pa. App. filed Aug. 9, 1906. Relates to modifications of the above.

848,752. TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Aug. 27, 1906. Provides means for bringing the movable element of a syphon recorder back to its normal or zero position after each impulse received. Has a shunt embracing the armature of an electromagnet, and a stationary contact therefor, by which a local shunt circuit is closed only during the return movement of the armature to normal position.

848,753. ELECTRIC RECEIVING DEVICE; Isidor Kitsee, Philadelphia, Pa. App. filed Sept. 8, 1906. Refers to a form of syphon-recorder by which very feeble currents can be received. Has magnets operating on diaphragms and thread connections therefrom to a mirror or syphon.

848,793. RELAY STRUCTURE; Harry G. Webster, Chicago, Ill. App. filed Feb. 4, 1907. Relates to telephone relays of the type adapted to automatically close a number of circuits by the attraction of the relay armature. Has a bell-crank armature engaging the first of a series of spring blades.

848,814. TELEPHONE TRUNKING SYSTEM; William W. Dean, Chicago, Ill. App. filed July 26, 1902. The combination with a trunk line adapted to connect telephone lines together for conversation, of a relay at the incoming end actuated by current over the trunk from the outgoing end, a second relay at the incoming end, a signal also at the latter end whose actuation depends upon said relays, said second relay being initially actuated over a local circuit, and a locking-circuit therefor to maintain the relay actuated substantially as described.

848,819. BUSHING COUPLING; Charles A. Freeman East Orange, N. J. App. filed Nov. 27, 1906. A piece of sheet metal is stamped into the form of a bushing with an embossed thread so as to be capable of making a screw engagement with a piece of flexible metallic tubing of the usual spirally wound form.

848,849. TELEGRAPHY; Walter P. Phillips, New York, N. Y. App. filed July 27, 1904. A telegraphic recording instrument comprising in combination, two oppositely-acting magnets, armatures facing the poles of said magnets and rigidly connected together, a recording device carried by the armatures, flat springs supporting said armatures and adjustable supports for the opposite ends of the same, whereby said springs tend to maintain the armatures in a position of symmetry with respect to the magnets, as set forth.

848,888. OUTLET BOX; Frederic W. Erickson, New York, N. Y. App. filed Jan. 29, 1907. Provides means for adjusting the outlet fuse of an outlet box to any level corresponding to a wall or partition. Has a series of spiral shims which are superposed upon one another in sufficient number to raise the box to the required level.

848,893. SWITCHING DEVICE; Edward F. Gehrkens, Schenectady, N. Y. App. filed Oct. 22, 1904. A device for cutting sections in and out of a sectionally wound transformer without actually bridging the sections in the usual way which produces excessive current and sparking at the contacts. Has an automatic circuit breaker which opens the circuit before the blade leaves a dial contact, so that the heavy current is never opened on the dial contacts.

848,902. ATTACHING PLUG AND WALL RECEPTACLE; James J. Hartley and Frank C. DeReamer, Schenectady, N. Y. App. filed April 22, 1905. Designed to provide an attaching plug and a flush wall or flush receptacle. Includes a face plate having two apertures to receive the pins, and a base secured to the face plate and containing two pockets in line with said apertures. Each pocket has a metallic socket to receive the pin, and a spring contact connected with the binding screw.

848,915. TRIP COIL FOR CIRCUIT BREAKERS; Ezra B. Merriam, Schenectady, N. Y. App. filed Feb. 15, 1905. Relates to automatic circuit interrupting means and is designed to vary the load under which the trip device will be automatically operated to break the circuit. Has means by which a change in the calibration of the mechanism may be effected temporarily and at the will of the operator Has a magnet with differential windings and a circuit changer for varying the arrangement of the circuits thereof.

848,923. ALTERNATING CURRENT METER; William H. Pratt, Lynn, Mass. App. filed July 25, 1906. A mercury meter of the type in which the torque is produced by coacting armature and field currents. Allows the current in the potential circuit to lag, and provides phase controlling devices in the series circuit. In this manner the currents in the series and potential circuits of the meter are brought into phase.

848,925. ELECTRIC GOVERNOR; Ernest Schattner, Schenectady, N. Y. App. filed Oct. 6, 1904. Two motors are driven from the alternating power circuit of the generator whose speed is to be made constant. One of these motors is shunted by a capacity and the other by an inductive reactance. The effect of change of speed in the generator and in the periodicity produced thereby is opposite on the capacity and inductance reactances, so that the two motors change their speed relation and a differential connection becomes effective to control the water wheel or prime mover.

848,926. SYSTEM OF MOTOR CONTROL; Carl Schiebeler, Berlin, Germany. App. filed Sept. 5, 1905. Circuits for the controllers of elevators in which it is desired to have the motors act as breaking generators under certain circumstances.

848,935. SYSTEM OF ELECTRICAL DISTRIBUTION; Matthew O. Troy, Lynn, Mass. App. filed July 19, 1902. Relates to the operation of arc lamps in a series alternating circuit energized from a separate power circuit of fixed alternating voltage. Has the form of constant current transformer together with condensers in the arc lamp circuit.

848,936. MEANS FOR IMPROVING THE POWER FACTOR OF ALTERNATING-CURRENT CIRCUITS; Matthew O. Troy, Schenectady, N. Y. App. filed Sept. 21, 1904. The combination of a source of alternating current, a circuit taking lagging current therefrom, and an independent circuit taking leading current from said source, the last-mentioned circuit including a condenser provided with means for eliminating the effect of minor harmonies.

848,939. ELECTRIC HEATING UNIT; Tycho Van Aller, Schenectady, N. Y. App. filed Dec. 29, 1905. A form of cigar lighter having substantially the shape and size of an ordinary porcelain plug. The bottom surface thereof is inlaind with resistance coils which can be heated to ignite the cigar.

848,940. ELECTRIC SWITCH OPERATING APPARATUS; Ira L. Van Buskirk, Louisville, Ky. App. filed Sept. 13, 1906. An ordinary knife-blade switch has a spring by which it is impelled into circuit opening relation, but is normally held close by a detent. This detent has a cord or wire therefrom to any desired point by which it is released.

848,941. ELECTRICAL CONNECTING PLUG; Frederick M. Vogel, Lynn, and Charles E. White, Malden, Mass. App. filed Feb. 25, 1905. A coupling for two-wire electric cables. Has an insulating block with a plurality of straight holes or bores therethrough, and a threaded

sleeve and stud within the bores and both engaging the walls thereof by which they are centered and supported.

848,944. REVERSE CURRENT DEVICE; Edmund B. Wedmore, Rugby, England. App. filed Nov. 11, 1905. A form of relay or device for actuating a circuit breaker upon reversal of the line current. Has a magnet coil acting on a single solenoid and wound with separate series and shunt windings. When these assist one another the core is raised to impinge against a detent.

848,954. PROCESS OF MAKING RESISTANCE DEVICES; Lawrence E. Barringer, Schenectady, N. Y. App. filed Feb. 5, 1906. The process for making a resistance which consists in placing a spiral resistance coil in a suitable base and mold and filling the interstices with a compound of silicate and a hydrate and subjecting the whole to steam treatment.

848,958. SELECTIVE SIGNAL SYSTEM; Elmer F. Bliss, Schenectady, N. Y. App. filed July 12, 1906. A device of the messenger call type in which semaphore signals are selectively set by a current having a predetermined number of pulsations. Has a current of reverse polarity for actuating the release mechanism.

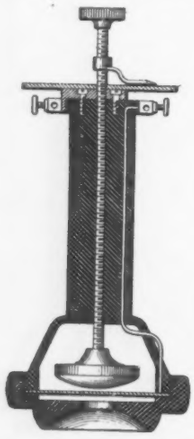
848,959. BLOCK SIGNAL SYSTEM; Elmer F. Bliss, Schenectady, N. Y. App. filed Sept. 19, 1906. Relates to modifications of the above.

848,970. SYNCHRONISM INDICATOR; Paul L. Clark, Chicago, Ill. App. filed Oct. 19, 1903. A form of mechanical indicating device which designates the instant when it is safe to close the controlling switch on an alternating current machine which is coming up to the speed of other motors already running and with which it is to be connected in multiple. Has two relatively movable transformer coils, one of which is operatively connected with a signal lamp and the other connected across the controlling switch.

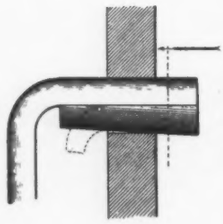
848,982. PROTECTION OF PARALLEL TRANSMISSION LINES; Anders Fjare, Schenectady, N. Y. App. filed Oct. 17, 1904. Relates to the protection of parallel transmission lines or feeders, and has means for opening the circuit of any one of the transmission lines or feeders when a short circuit occurs thereon without interrupting the circuits of the other feeders.

848,983. RAIL-BOND; Walter E. Foster, Chicago, Ill. App. filed Dec. 6, 1905. Rail-bond formed of a number of copper wires of semi-cylindrical section. Is passed through the usual hole in the rail and secured by a semi-conical wedge.

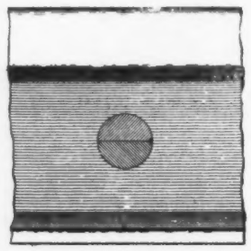
848,988. SYSTEM OF GUN CONTROL; John L. Hall, Schenectady, N. Y. App. filed Nov. 28, 1904. A means for sighting a gun from a controlling device at a distant point. Has means for moving the gun

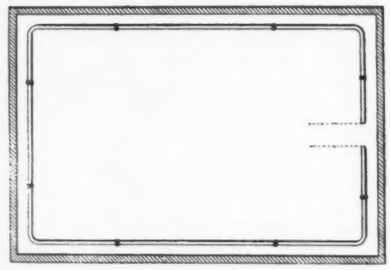


848,675.—Water Meter.



848,983.—Rail Bond.





849,009.—Method of Electric Lighting.

in parallelism with an arm and means for adjusting the arm parallel to the line connecting the gun and target.

848,994. ELECTRIC JUNCTION AND OUTLET BOX; Otto C. Hoffmann, New York, N. Y., and Albert I. Appleton, Chicago, Ill. App. filed Nov. 8, 1906. Junction or outlet box of the type used in house wiring and suitable for the reception of electric switches, fuse boxes and similar appliances. Has means whereby the boxes are rendered extensible or adjustable as to length.

849,009. METHOD OF ELECTRIC LIGHTING; Daniel McF. Moore, Newark, N. J. App. filed April 18, 1903. Covers the broad features of the Moore electric light in which a glass tube is joined in a continuous length around the area to be illuminated. The patent describes this arrangement of the tube, and that it is filled with a conducting gas of predetermined attenuation, and traversed by an electric current. The claims relate to the method of illuminating by a tube which extends around the area desired.

849,028. CONNECTOR FOR ELECTRIC CONDUCTORS; George E. Stevens, Lynn, Mass. App. filed Feb. 11, 1904. A terminal fastener or end for flexible cables. Is stamped of sheet metal so as to form a sleeve for the insulated portion of the conductor, and a beaded ring in which the bared copper is received.

849,032. TELEPHONE SYSTEM; Charles A. Wardner, Brushton, N. Y. App. filed Dec. 7, 1905. A party-line telephone system, comprising a main circuit having two metallic conductors, a supplemental conductor, a common ground return for one or more of said conductors, and means whereby one of said conductors and the common ground return may be utilized for talking purposes while the main circuit is being used.

849,085. DYNAMO-ELECTRIC MACHINE; Emanuel Rosenberg, Berlin, Germany. App. filed Aug. 1, 1904. The combination of a three-wire dynamo electric machine having a main winding connected to one of the outside mains of the system, and an auxiliary winding traversed by current flowing in the neutral conductor of the system.

849,089. SOCKET KEY FOR ELECTRIC LAMP SOCKETS; Philip L. Sylvester, Scranton, Pa. App. filed July 5, 1906. A socket key formed of plastic composition molded around a split and embossed rod so as to be firmly anchored thereto.

849,116. GAS LIGHTING APPARATUS; Ernest A. and Edward N. Frary, Deerfield, Mass. App. filed March 9, 1906. A chamber has a diaphragm which is displaced by the pressure of the gas when turned on. The movement displaces a plunger to close the circuit of a magnet which actuates the ignition device of the burner.

849,120. BRUSH HOLDER; Frank W. Garrett, Norwood, Ohio. App. filed June 23, 1905. Is designed to prevent chattering of the brush in spite of irregularities in the commutator surface. Has a clip mounted on the upper end of the brush and a spring piece carried by the clip and a pressure finger raising the spring piece.

849,148. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; Frederic W. Lord and Frederic W. Erickson, New York, N. Y. App. filed Jan. 28, 1907. A device for temporarily grounding a circuit in case of heavy currents due to lightning discharges or any other cause. Has a plurality of electrodes on a rotatable member each of which is adapted to form a bridge between the line wire and ground electrodes, together with a motor for rotating the electrodes and providing an oil film thereover.

849,157. ENGINEER'S ALARM; Edward McClintock, Merriam Park, Minn. App. filed Nov. 6, 1905. Has special trolleys laid between the track rails with circuits by which the steam of a locomotive is automatically cut off in case a following train approaches too close to a preceding one.

849,159. FUSE CLIP; Frederick R. Parker, Chicago, Ill. App. filed March 14, 1906. A form of spring support for fuse cartridge. Not only holds the fuse cartridge in place, but also removably engages a contactor at one terminal or connection.

849,170. ELECTRIC SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Dec. 3, 1902. Relates to electric signaling and is designed to utilize alternating pulsating or fluctuating currents. Has a translating device responsive to alternating currents, but unresponsive to a modification of the alternating current, and means for modifying the alternating current under certain circumstances.

849,171. ELECTRIC SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Dec. 3, 1902. Relates to modifications of the above.

849,172. ELECTRIC SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Dec. 3, 1902. Covers additional modifications.

849,173. SIGNALING SYSTEM FOR ELECTRIC RAILWAYS; Jacob B. Struble, Wilkinsburg, Pa. App. filed Jan. 3, 1907. Additional modifications of the above.

849,216. POLICEMAN'S CLUB; Charles J. Diehl and Henry W. C. Eickhoff, Tippecanoe City, Ohio. App. filed Aug. 23, 1906. A form of policeman's club filled with dry batteries all joined in a common circuit with an electric lamp at one end.

849,226. ELECTRIC SIGN; William B. Garrett, Ashton, Ill. App. filed May 28, 1906. A solid bank of lamps are joined by individual connections to segments correspondingly arranged on a concave surface. This surface is swept by a cylinder which engages the segments to close the lamp circuits in predetermined combinations.

849,250. COMBINED TELEPHONE DESK-STAND AND CALL-BELL; Charles A. L'Hommedieu, Buffalo, N. Y. App. filed Jan. 5, 1905. Has a bell embodied in the base of a standard of a desk telephone.

849,262. TROLLEY WHEEL; George B. Nussbaum, New Philadelphia, Ohio. App. filed Dec. 6, 1906. The trolley harp is swiveled on a vertical axis to the usual pole and has an arm laterally projecting therefrom and through which the usual cord passes in such a way as to keep the wheel in normal alignment with the pole.

849,275. TERMINAL FOR ELECTRICAL MOLDINGS; Reuben Simon, New York, N. Y. App. filed May 9, 1906. A terminal end for a molding constructed of porcelain having substantially the shape of the molding, but rounded so as to give an ornamental finish and prevent abrasion of the wires.

849,287. ELECTRIC SIGNAL SYSTEM; William M. Thomas, Chicago, Ill. App. filed Aug. 3, 1906. Has a plurality of handles, any one of which when operated closes the circuit of a common magneto-generator through a selected telephone line.

849,296. DETECTOR DEVICE; Simon W. Wardwell, Providence, R. I. App. filed Jan. 24, 1906. An apparatus for detecting defective insulation particularly in the winding processes of preparing and making electrical coils for electromagnets and similar purposes where perfect insulation is essential. Has a helical spring in one of the grooves guiding the pulleys which makes contact with an defective portion of the wire.

849,335. ELECTRIC DENTAL FURNACE; Louis Markwitz, San Francisco, Calif. App. filed Jan. 22, 1906. A small muffle is mounted on a supporting base having a resistance therein which is controllable by a small rheostat. The muffle has a heating coil and the temperature is regulated by said rheostat.

849,336. SIGNALING SYSTEM FOR TELEPHONE EXCHANGES; Frank R. McBerty, Evanston, Ill. App. filed Jan. 20, 1905. Relates to the signaling circuits of a simple exchange system having single cord circuit connections.

849,343. CASING FOR ELECTRIC SIGNALING INSTRUMENTS; Eugene W. Bogel, Chicago, Ill. App. filed Feb. 24, 1902. Relates to boxes or casings for enclosing and protecting electrical signaling instruments. A two-part casing is made of cast iron so as to telescope together and provide suitable outlet openings in the base thereof in a relation to shed water and moisture from the interior of the box.

849,353. ELECTRIC EAR-PHONE; Lewis F. Clarke, Boston, Mass. App. filed Feb. 13, 1907. An electric ear-phone, comprising a pocket battery having separated contact-plugs projecting from its upper end, combining with a transmitter having a socket-piece provided with separated sockets adapted to align with and receive said plugs, and circuit terminals held by said socket-piece and engaged with said sockets.